S. HRG. 101-1160

GLOBAL CHANGE—WHAT YOU CAN DO

HEARING

BEFORE THE

COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION UNITED STATES SENATE

ONE HUNDRED FIRST CONGRESS

SECOND SESSION

ON

RESPONSES TO GLOBAL CHANGE—WHAT YOU CAN DO

APRIL 25, 1990

Printed for the use of the
Committee on Commerce, Science, and Transportation

U.S. GOVERNMENT PRINTING OFFICE

38-022 O WASHINGTON : 1990

S261-36

For sale by the Superintendent of Documents, Congressional Sales Office
U.S. Government Printing Office, Washington, DC 20402

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GLOBAL CHANGE—WHAT YOU CAN DO

WEDNESDAY, APRIL 25, 1990

U.S. SENATE,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
Washington, DC.

The committee met, pursuant to notice, at 9:38 a.m. in room SR-253, Russell Senate Office Building, Hon. Albert Gore, Jr., presiding.

Staff members assigned to this hearing: Mike Nelson, professional staff member, and Fiona Branton, minority staff counsel.

OPENING STATEMENT BY SENATOR GORE

Senator GORE. The committee will come to order. I would like to welcome all of our guests and all of our witnesses.

Today the Commerce Committee will consider what each of us can do to prevent greenhouse warming, ozone depletion, acid rain, and other threats to the global environment. Over the last two years, the Commerce Committee has held more than a half dozen hearings on the damage we are doing to the global environment.

Most of those hearings have focused on global change research being done to help us better understand and assess the impacts humankind is having on the environment. We have heard from some of the country's most eminent atmospheric scientists and, frankly, what they have had to say is indeed alarming.

If present trends continue, we will double the concentration of carbon dioxide in the atmosphere by the middle of the next century. Climate models indicate that could cause between three and eight degrees Fahrenheit of global warming and, more importantly, will cause major unexpected changes in the climate patterns.

Marine ecosystems, agriculture, forestry, human health, all will be adversely affected unless we take steps to prevent the damage now mounting.

As troubling as these projections might be, of even more concern are the unpleasant surprises that cannot be predicted. Some oceanographers, for example, have speculated that the changes might not be gradual, but could cause a sudden change in the pattern of ocean currents and prevailing winds. Meteorologists have predicted that global warming could cause a dramatic increase in the intensity of storms, with hurricanes 50 percent more powerful than presently is the case.

There are other large potential effects that have been discussed on television, in cover stories on major news magazines, and in the nation's newspapers. In the last few years, the American public has come to stand face to face with the magnitude of the threat facing

the global environment, and with that understanding has come a desire to do something about the problem.

People across America and around the world are asking, what can I personally do? That is why last Sunday millions of people took part in Earth Day. There were hundreds of thousands of people down on the Mall, learning about what actions they can take to reduce the energy they consume, the waste they produce, and the other steps they take that presently cause harm to the environment.

We want to keep that momentum going, and that is why our committee arranged to have this hearing today, during the week following Earth Day. We should not let Earth Day be an event that happens and then disappears, to be forgotten.

So at this hearing today we will hear about what individuals can do in their own homes and their own lives to protect the environment and prevent the damage now underway.

Our first witness, John Javna, is the man most responsible for "50 Simple Things You Can Do to Save the Earth," a national best-seller containing advice on everything from energy efficiency to recycling to disposable diapers. In the last few months this book has sold more than 1.6 million copies.

There are now dozens of similar books on the market as well. There is even a book of "Heloise's Household Hints for a Healthy Planet." These books are full of simple things you can do to reduce global warming: plant a tree, install energy efficient lightbulbs and appliances, do not use pesticides and herbicides on your lawn, et cetera.

But there are some other things you can do as well which require a little more effort. These include recycling and composting your trash, replacing your lawn with plants that require less watering and fertilizer, using mass transit, and the like.

Some of these steps are easier for some than others. For example, it is not very easy to use mass transit if you happen to live in rural Tennessee. The important thing to remember, though, is that every little bit helps.

At this hearing we will see how the Federal government can encourage families to take action to protect the environment, and indeed there are many ways the Federal government can help. Each year it spends hundreds of millions of dollars on research into energy efficiency, alternative energy technology, and other ways to reduce pollution.

Some of today's witnesses will describe and evaluate this research and help the committee determine what more can be done.

The government can also help provide consumers with information they need to make wise environmentally sound decisions about the products they buy. And the government can do a lot to promote recycling and pollution reduction. The government itself can be a better consumer.

For example, the Federal government owns almost half a million automobiles. We ought to make sure that each one of them is fuel efficient.

Last year the Federal government used about 200 million pounds of paper. No telling how many trees that represents. Just using double-sided Xeroxing a little bit more could reduce that number

substantially. Think of how many trees could be saved by that step alone.

Well, the time to act is now. We have the information we need to start taking intelligent action.

Just last week, the Intergovernmental Panel on Climate Change released a draft of its long-awaited report designed to settle some of the ongoing arguments about global warming, and they came to the conclusion that it is definitely real and will warm the Earth by three to eight degrees Fahrenheit over the next several decades unless we take action now.

We have three young witnesses here today who are all rightfully concerned about these projections because they are going to be living until the year 2050 and beyond.

Unfortunately, though, the Administration has yet to acknowledge that the time to act is now. They say the evidence is not in yet. I strongly disagree.

But even the Bush Administration says that we should be taking actions that make sense regardless of global warming, actions like increasing energy efficiency. It is hard to argue against that. Recycling falls into the same category. It saves energy and reduces the need for additional landfills and incinerators.

We all need to be doing more. Today's hearing will help us determine how we can best do that. I am looking forward to hearing from our witnesses because they all have very important insights to share.

Before calling our first witnesses to the table, I would like to acknowledge and recognize the ranking Republican member of our subcommittee, Senator Pressler.

OPENING STATEMENT BY SENATOR PRESSLER

Senator PRESSLER. Thank you, Mr. Chairman.

I am pleased we are holding this hearing today. It is important that we continue to build on the success of Earth Day held this past weekend. We should view Earth Day as a starting point for environmental action, rather than as only a single day dedicated to the cause.

The hearing is a recognition of the need to go further in this important area. I think it is important that we are all aware of conservation suggestions that are brought forth, such as "50 Simple Things You Can Do to Save the Earth." I am told that the upper income stratum of Americans is over-housed. I note that this book tells us things we can do to conserve heat, air conditioning, water and so forth.

One person noted that it was passing strange that, with all the movie stars speaking at the earth day rally, no one mentioned that if you have a big, spacious house in Los Angeles and a big spacious house in Aspen and a big apartment in New York all at the same time, you are adding a lot to pollution through heat, light used, and so forth.

So we can all do a better job. I think it is extremely important to focus on what we as individuals can do to make a difference. In my home State of South Dakota, we are working on many important environmental issues, from surface mining to the beautiful Black

Hills to a low-level radioactive waste dump Nebraska proposes to place near our border.

South Dakotans recognize the environmental threats these projects pose and they work very hard to stop them. However, I think there is a great deal of confusion at the individual level over the value of the small steps each of us can take in our everyday lives to help make a difference in the struggle for a clean environment.

So I look forward to hearing the recommendations of our distinguished witnesses, and I plan to distribute those recommendations to the citizens of my State on recycled paper, of course.

Senator GORE. Thank you. Senator Bryan, do you have a statement?

OPENING STATEMENT BY SENATOR BRYAN

Senator BRYAN. Thank you, Mr. Chairman. As chairman of the Consumer Subcommittee, I am very interested in the role of the consumer in addressing our environmental problems.

Recent polls show that the future of the environment is the primary concern of most of Americans today. These reports come on the brink of warning that the Earth's ozone layer is in danger, there is a threat of global warming, and that we are running out of room for storage of our trash and nuclear waste. Scientists indicate that these developments may present a grave threat to the preservation of our environment, and that we must take immediate action to combat these serious problems.

However, many of the environmental problems we face today have resulted from our own human activities, including our individual lifestyles and actions. And of course, if we have the power to create it, we have power to prevent it. I am hopeful that all citizens, through our own individual actions, can help preserve and protect our environment. Information related to environmental issues, including the labeling of consumer products for this purpose. We hope to schedule a hearing next month, and consider Senator Gore's recycling legislation, S. 1884, shortly thereafter.

I am looking forward to hearing the suggestions and recommendations from todays witnesses on how consumers, and Congress can work together toward these important goals.

Senator GORE. Thank you.

I have a statement that Senator Kasten would like to have included in the record.

[The statement follows:]

OPENING STATEMENT BY SENATOR KASTEN

Mr. Chairman, this will be an interesting hearing focusing on the actions that each one of us can take in our daily lives to help improve the global environmental situation.

Often news reports focus on governmental action regarding the environment—large projects or policy decisions that almost seem to overwhelm the individual as to the nature of the problem we all face.

Just as confusing are the reports one day of the terrible strain that paper diapers are putting on our land fills that are nearing capacity. Then the next day we'll hear of the adverse environmental impact of washing the cloth diapers that were seen as the easy solution just the day before.

There are many things that each of us can do that do not require big changes in life style, yet can have a significant impact. I suppose we've all been told since

childhood to turn off lights when we leave a room. Now more than saving on the electric bill, this simple action can produce big savings in the loading of the atmosphere with green house gasses.

If every American turned off a 100 watt light bulb for 1.5 hours per day it would have the same impact on carbon dioxide loading as the planting of one billion trees. Talk about one ounce of prevention being worth a pound of cure!

So, I look forward to this hearing focusing attention on the individual contributions each one of us can make in working to produce a safer, healthier environment for this planet. This is something that must be worked on from our households to our communities to our state and federal government, and among nations.

Thank you, Mr. Chairman.

Senator GORE. Well, let us call our first panel to the witness table: Mr. John Javna of the EarthWorks Press in Berkeley, California; Mr. Chris Calwell, a research associate with the Natural Resources Defense Council; and Dr. John and Mrs. Kathy Dewey and their children Brad, Molly, and Ben of Fairfax, Virginia.

We are going to put a couple extra chairs up here for Brad, Molly, and Ben. Let me say while they are coming up to the witness table that John and Kathy Dewey and their children were featured in a recent Washington Post article on the environment. In many ways, the Dewey family is representative of the millions of families throughout the country who are trying to do what they can to protect the environment, but finding that unfortunately it is not always easy.

The Deweys are going to discuss what they are doing to help the environment and the tradeoffs they face when doing so.

I mentioned that Chris Calwell is with the Natural Resources Defense Council. He works on energy conservation and global change issues and actually contributed much of the technical data for "50 Simple Things You Can Do to Save the Earth"

John Javna, with whom we will lead off this panel, as I mentioned wrote this book, and it may not have been a surprise to him, but to some in the publishing industry it was a surprise to see this book really take off and get to the top of the "New York Times" bestseller list. I think it shows how much interest there is on the part of average Americans in finding out exactly what we can do to solve this problem.

Mr. Javna, congratulations on the success of your book. Please lead off this panel, and we welcome you here.

STATEMENT OF JOHN JAVNA, THE EARTHWORKS PRESS

Mr. JAVNA. Thank you.

By the way, it was a tremendous surprise to us. We had no idea.

Senator GORE. A surprise to you, too?

Mr. JAVNA. Yes, it was a surprise.

Senator GORE. A pleasant one.

Mr. JAVNA. Well, very pleasant. Nice to know that people really cared.

My name is John Javna. I am the co-founder of the EarthWorks Group. I am also a publisher and the principal author of three books about the environment: "50 Simple Things You Can Do to Save the Earth," "30 Simple Energy Things You Can Do to Save the Earth," and "50 Simple Things Kids Can Do to Save the Earth."

I am not a scientist. I am not an expert on environmental law. I am just an average baby boomer.

Over the past decade I had heard an awful lot about the enormous environmental problems confronting us—acid rain, global warming, ozone depletion. But I never really heard much about solutions. And like a lot of other Americans, I assumed there was very little I could do. Certainly there was very little that one individual could do.

But finally last year, I just had enough and I decided that there had to be something, some way that I could have a positive impact on the Earth in my everyday life. So I called a lot of local environmental organizations, and I found that the information I was looking for did exist, but not in a form that an average person could understand, and it was not all in one place. It was all spread out in various, dozens and dozens of periodicals and books.

There was no single guide, in other words, that the average American could follow, and so I decided to write one. There were some parameters I wanted to use. One was I wanted to make sure that all the information was very accessible; there was no preaching, no telling people what they should do, just telling people what they could do.

I wanted to make sure that the information was easy to understand and easy to enjoy. I wanted to make sure that people could translate the information into action. And most of all, I wanted to show how one individual could make a difference, how one person could have the power to change the world, even just a little, and how working in concert with other people we could change it a lot.

My first task was to go to Washington and try to dig up as much information as we could find. I took my backpack along and went from environmental organization to environmental organization. I stopped in government agencies, trade organizations.

Besides finding enough information to fill about five cartons, I found out how confusing the environmental maze would be to an average person. And I got very confused going from the Environmental Defense Fund to the Environmental Policy Institute to Environmental Action and, of course, to the Environmental Protection Agency, which I was surprised to find is in a shopping mall. It is located in a shopping mall.

Anyway, we got the information together and sent it back home, where about a dozen people, researchers and writers, sorted through it. We finished the book in October and by November it was printed.

As we were putting the book together, we were really surprised to find out how many things there were to buy and do that we had never heard about that were Earth-positive, things like low-flow shower heads which cut the amount of water that is used in a shower by half, from five to seven gallons to 2.5 gallons, without asking—and here is one. It is small, but boy, is it powerful.

Senator GORE. How much does it cost?

Mr. JAVNA. It costs about 14 dollars. The one I have got costs 14 dollars. And it of course pays itself back in energy costs and water savings very, very quickly.

We found that, running a few simple numbers, we found that a family of four could save easily over 10,000 gallons of water a year just by installing one of these in their shower.

Anyway, we had never heard of these things before, and we did not understand why, but we felt it was our duty and responsibility to pass that information on to people. It made it a good feeling to do this book.

But we had no idea that anyone was going to read it. We just hoped they would. We decided to print 25,000 copies. It seemed like a lot to us, and of course in the publishing industry it is a lot. We scraped the money together. We found the recycled paper, which was difficult, and we went ahead with it.

We were really surprised when about a week later the book was sold out, completely sold out. Our phone started ringing off the hook, and that actually meant my phone because this was all done out of my home office. And it got crazy, and it has been crazy ever since.

The phone is still ringing. Newspapers are still calling. Television is still calling, trying to get us to show up for interviews.

We got orders from everyone from Greenpeace to Charlton Heston. The rap group REM bought copies to give to each member of their fan club. The sitcom "Alf" did a show based on the book.

The book hit, as you mentioned, number one on the New York Times bestseller list. It has been there for nine weeks and as I understand next week it is also. And we sold over 1.6 million copies in three months.

That is an astonishing thing in the publishing industry, but to us it was astonishing because there was no indication that people really were that concerned about the environment.

In addition, we started to do some books that were kind of based on it. The kids book is also a bestseller now. It has been out only two weeks and it is number three on the New York Times bestseller list next week. Even the White House gave the book out at its Easter Egg Hunt last week.

Senator GORE. The kids book is where on the list now?

Mr. JAVNA. Number three. So number one and number three.

Senator GORE. "50 Simple Things" is number one and "50 Simple Things Kids Can Do" is number three?

Mr. JAVNA. That is correct, Senator.

Senator GORE. What is your next one?

Mr. JAVNA. It is called "The Next Step: 50 More Things You Can Do."

Senator GORE. How about "50 Simple Things Senators Can Do"?

Mr. JAVNA. Someone is working on a book called "50 Simple Things Government Can Do," I think.

We also did an energy book which we made available to utilities, called "30 Simple Energy Things You Can Do to Save the Earth." It is a smaller book, but it is strictly energy conservation. It positions energy conservation as an environmental concern, not just a patriotic or an economic concern.

We instantly got a good reception from utilities. The largest utility in the country, PG&E, bought 500,000 copies and distributed them for free to its customers. Now other utilities are also interested in it. And we have copies here. This is a copy of the book.

But it is very exciting. But the most exciting part of the whole thing was the response of the average citizen, people like myself, to the book. Right from the very first week the book came out, we were stunned, absolutely stunned, by the response.

First of all, we were stunned because we did not know that people felt the same way we did. But more, we were stunned because of what people said. Letters would arrive, and not just one but dozens of letters would arrive, with the words "Thank you, thank you, thank you" at the beginning. People expressed their concern, their hopes, and their frustration to us in a way that we never expected.

I suspect that other people had no idea that this, this feelings about the environment, ran as deeply as they seemed to.

I thought I would read a letter that we received from a kid, a child. We were surprised to see that children know as much and perhaps more than adults do about the environmental problems we are all facing. This one says:

> My name is Amanda Geml. I am nine years old and in the fourth grade. I love your book. I learned so much from it. If every single household did simple acts we would have a beautiful world.
>
> Some people just sit back and relax. I almost am brought to tears when I think what the world will be like when my children have kids. But unless we act now, two generations from now this Earth will not be worth living in. I know some people are helping, but we need everyone to help.
>
> Thanks so much. Amanda Geml.

That is from a nine year old. We got similar letters, of course, from many adults, and kids continue to write. It gives me great hope and also makes me understand what an important task we have in front of us.

About three weeks ago, my son Jesse was born, my first child, and I can tell you that I realized how much different it is to talk about the future than it is to hold it in your hands and see it staring back at you. And I found it gave new meaning to the whole process of doing these books and of taking care of the environment.

I know that people—well, on behalf of Jesse and on behalf of the millions of people who have read the books, I am really honored to be here and to ask you and to tell you that they are eager to be led. I know they are eager to be led because they are telling me so.

For Jesse's sake, I hope that you will take that responsibility and help us, support and guide us in doing something to protect our world.

Senator GORE. That was really a great statement. I appreciate you coming and sharing that with us. That was really terrific.

I have got some questions and I know my colleagues do. Our practice is to wait until everybody has gotten through and then we will ask questions.

Mr. Calwell, you helped to provide some of the technical advice on which John Javna's book was based, and we are anxious to hear from you this morning. Welcome.

STATEMENT OF CHRIS J. CALWELL, RESEARCH ASSOCIATE, NATURAL RESOURCES DEFENSE COUNCIL

Mr. CALWELL. Thank you.

I am Chris Calwell, a research associate in the San Francisco office of the Natural Resources Defense Council, and NRDC pursues a broad range of environmental and energy issues on behalf of some 135,000 members across the country. My own work at NRDC encompasses energy efficiency, global warming, and I guess what I have titled the individual action side of solving environment problems.

John and I began working together actually last fall, when he called me seeking some additional energy facts for the original book, "50 Simple Things You Can Do to Save the Earth." I think I shared his concern that the information needed to help people take action, though known at environmental organizations and some levels of government, had not been disseminated in an easy to understand form.

That is why I agreed to contribute some facts and technical editing to the book and also wrote the introduction to the book.

Subsequently, John and I and a third author, as he told you, wrote "30 Simple Energy Things You Can Do to Save the Earth," and utilities have now purchased 600,000 of those books to give away to their customers.

The tips in both books are deceptively simple, really, so simple in fact that I could stow the means to accomplish a few of them in a very small carry-on bag. Actually, it is a canvas bag, which is similar to the ones that thousands of our readers have been taking to the store because they are better for the environment than paper or plastic bags.

This is a compact fluorescent bulb, which many people have heard about and fewer people have seen. It is a consumer version of a breakthrough technology developed in the Federal labs, actually, back when Federal funding for energy efficiency was somewhat higher than it is today.

The compact fluorescent light uses one-fourth as much electricity as an equally bright bulb next to it. It lasts 13 times as long and it would eliminate the need for a $5 billion nuclear power plant if it was made widely available to America's homeowners.

Senator GORE. How much more does it cost?

Mr. CALWELL. When you buy the bulb the first time, it costs about 15 dollars.

Senator GORE. Compared to?

Mr. CALWELL. Well, this bulb is 75 cents, but you are going to need 13 of them before this one burns out.

Senator GORE. So how long before you get your initial money back?

Mr. CALWELL. It depends, of course, on how long you keep the lights on. Obviously, people who put them in a porch light, for example, that stays on eight hours a night are looking at a payback around a year. Otherwise, it could be as long as two or three years.

But the utilities have made a number of steps, taken a number of steps, to make it easier for people, which include buying the bulbs in bulk purchases and then giving rebates to customers.

I actually show you the compact fluorescent today in the hopes that its next appearance in these halls will be as an installed Federal energy-saver in the fixtures overhead.

Senator GORE. What? What? You mean us?

Mr. CALWELL. I know, a ludicrous proposition perhaps.

I saw in a recent press release from Claudine Schneider that the Capitol Architect's Office is already trying super-efficient lighting on a trial basis.

Senator GORE. Let me interject, seriously, as a member of the Rules Committee to tell you that this has been the subject of much discussion in the Senate, as well as the House, and steps are under way.

I joked about the "50 Simple Things Senators Can Do," but in truth we are taking such steps, and thank you for reminding us.

Go ahead.

Mr. CALWELL. Sure. I guess we at NRDC would dare to hope that the committee would see the virtues of expanding the experiment to these halls as well in the interest of cutting the Federal government's multi-billion dollar energy bill.

Compact fluorescents as bright as 100 watt incandescent bulbs are also on the market, and some have reflectors. I will show you one of those briefly.

This would fit in a ceiling can and it does not have as many uses in a home, but it is quite useful in offices and places like this, where you have directed lighting above. And it also comes on instantly and is generally better for pointing down at things than pointing into people's eyes.

There are also other compact fluorescents that are even smaller and are short enough to fit into most existing fixtures.

Actually, the fact that each one prevents about a thousand pounds of carbon dioxide emissions at the power plant over its lifetime has made the compact fluorescent a very powerful technology to our readers. But they cannot always find them in stores, nor can they justify spending, say, $15 to save $40 on future electric bills.

I actually urge you now to use Federal purchasing power, if possible, to make them more readily available and to reduce their purchase price. As we all know, the Federal government is one of the biggest consumers of goods and services in America.

Also, as you have seen, this is a super-efficient shower head. There are many designs available. This one uses about two and a half gallons of water per minute and it cuts people's hot water use in half, but it does not ask them to make a sacrifice, and that is the key difference.

As John correctly reasoned when he wrote the book, you do not need to tell people to take shorter showers if taking long showers makes them happy. It is far more important to just use the hot water efficiently while they are in the shower.

It is a similar principle with the lights. We are not asking people to live in dark, cold rooms, but rather to get the same amount of light in a more efficient fashion. All people really need to know about things like this is where to buy them.

Also, I wanted to show you a super window, which looks like this, only typical examples are much bigger than this. I could not bring a full one with me. This window insulates as well as eight panes of glass and, as we said in the energy book, up to 40 percent of the energy used in our homes is for heat. Half of that is lost through leaks in walls and windows.

So this window plugs the leaks four times better than typical construction and represents yet another milestone in energy efficiency, which was made possible, as you might guess, by Federal funding for research and development.

We sent full-sized super windows like this one to the NRDC Soviet Energy Project's site in Byelorussia, and we enthusiastically commend them and the other energy savers that I have already mentioned for use in Federal housing and Federal buildings of all types.

Finally, I have devoted significant attention to other government actions in my written testimony, which is titled "Ten Simple Things the U.S. Government Can Do to Help Its Citizens Save the Earth." However, there is not time to elaborate on them here.

I would just mention the list includes a number of Federal actions to allow consumers to buy more efficient automobiles, more extensive Federal labeling of products that contain ozone depleting substances or agricultural chemical residues, and third, more active Federal involvement in recycling and the purchase of products made from recycled materials.

If I could elaborate on Senator Gore's example, that would include using recycled paper in copying machines. We have found at NRDC that is incrementally more expensive and has a far greater impact even than printing double-sided.

Finally, we would recommend more intensive Federal support of energy efficiency research and State efforts to save energy through the utility system.

Other witnesses at today's hearing will, I am sure, have more items to add to this list. The point is not to recite a litany of failed or delayed Federal policies, but rather to emphasize the positive. That is the beauty of the "50 Simple Things" book. It has everything to say about solutions and almost nothing to say about blaming people for the failure to act before now.

The time is right to begin anew, and millions of Americans await your guidance and the leadership of the Federal government by example.

Thank you.

[The statement follows:]

TESTIMONY OF

CHRIS J. CALWELL

ON BEHALF OF

THE NATURAL RESOURCES DEFENSE COUNCIL

My name is Chris Calwell. I am a research associate for the energy program of the Natural Resources Defense Council. I am a co-author of "The Decline of Conservation at California's Utilities: Causes, Costs, and Remedies." I contributed facts and wrote the introduction to the popular citizen guide, 50 Simple Things You Can Do to Save The Earth. With John Javna and a third author, I helped create 30 Simple Energy Things You Can Do To Save The Earth. 600,000 of these books have been purchased by utilities since March.

NRDC is a national environmental organization with more than 135,000 members and contributors. Its staff of more than 120 lawyers, scientists, resource specialists and support personnel in New York, Washington, San Francisco, and Los Angeles pursue a broad range of environmental, energy and defense issues.

I have been asked to testify about the simple things mentioned in the books. I also offer here suggestions on what the government can do to make individual environmental action easier and more fruitful for the average American.

The phenomenal success -- from a publishers standpoint -- of "50 Simple Things You Can Do To Save The Earth" is testament enough to the desire of a huge number of people to make a

difference. Three days ago, nearly a million people gathered in Central Park in New York and hundreds of thousands celebrated on the Mall in an outpouring of support for Earth Day which was matched in almost every community in America and dozens of other countries. People want to participate in the process of improving the environment.

Indeed, at NRDC one of the questions we are asked most often is, "What can I do, as an individual, to make a difference in the battle to save the Earth?" This elemental urge to do the right thing is the principal reason that 50 Simple Things has sold 1.5 million copies and hovered at the top of the New York Times best seller list for the last three months.

The advice the reader gets from 50 Simple Things is sound advice. But there is an important point which isn't made in the book. Many barriers and misguided policies stand in the way of any individual who wants to live life in an environmentally sound way. The government could do a great deal to make 50 Simple Things come to life. Many of the measures we urge individuals to take would be infinitely more effective if the government began taking these issues as seriously as the public does. I have selected ten examples -- herein referred to as "10 Simple Things The U.S. Government Can Do To Help Its Citizens Save The Earth."

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1. Though automobile prototypes that exceed 100 miles per gallon (mpg) have been built, the manufacturers have brought no car to market that can achieve more than 60 mpg. Their average car manages less than 30 mpg. The federal government spent over $1.5 billion on new passenger cars and trucks in 1988. It should immediately issue an RFP for an 80-100 mpg car that meets all safety and emissions standards, to be used by federal employees in cases where less efficient cars are clearly unnecessary. This would give readers of 50 Simple Things and other Americans a chance to buy a super-efficient car if they wanted to.

2. 50 Simple Things encourages people to keep their cars tuned up so that they run cleanly and efficiently. But when Americans buy a new car, they're likely to achieve little improved efficiency in the current market. Today's fuel economy standard is no higher than it was in 1985 -- 27.5 mpg. For awhile, the standard was even lower, in spite of the fact that 78 percent of American voters expressed support in a recent poll for a 45 miles per gallon Corporate Average Fuel Economy (CAFE) by the year 2000. Congress should listen to its voters and set CAFE at 45 mpg or more by the year 2000. Equally important, it should institute a revenue-neutral system of fees and rebates to discourage people from buying inefficient cars with high tailpipe emissions and encourage them to buy efficient ones with low

emissions. Set up within the various size classes of cars, such a system should receive the support of America's automakers, who have long complained that consumers had no real incentive to buy efficient, clean cars.

3. 50 Simple Things encourages people to drive less, yet the government continues to encourage them to drive more by spending three times more money on highways than transit. In 1987, the federal government granted $11.2 billion to the states for highway construction and only $3.2 billion for mass transit. Recent NRDC research shows that every additional vehicle-mile traveled on transit displaces 5-10 vehicle-miles traveled in cars. Now that the Surface Transportation Act is due to be reauthorized, the Congress should devote serious attention not only to restoring funding to decimated transit budgets, but to spending real money on integrating walkways and bikeways with transit ways. This has already been done with great success in Japan and Europe. It's a simple thing, but it can make a big difference.

4. The IRS has stated its intention to tax rebates utilities give to consumers for the purchase of energy-saving appliances, etc. At a time when the causes of pollution like gasoline face minimal taxation, it is ironic that the IRS wants to discourage the purchase of devices which

prevent pollution. If anything, the IRS should consider offering credits to supplement utility rebates in offsetting the cost of energy-efficiency improvements.

5. 50 Simple Things encourages people to save energy through the use of compact fluorescent lightbulbs and efficient showerheads and appliances. What is the government doing to make this possible and to insure that better devices are speeding their way to market? The U.S. Department of Energy has a $17.5 billion; the amount authorized for efficiency R&D is only $200 million -- about 1%. That's less than 5/100ths of one percent of the national energy bill, which has crested $400 billion/year. Imagine if energy consumption were an industry, like computers or steel. Most mature American industries spend about one percent of their revenues on research and development. High tech industries typically spend a few percent or more. Even if we only spent one percent to develop more high tech ways to save energy like compact fluorescent bulbs and solid state ballasts, that would be $4 billion -- 20 times more than the current R&D budget.

6. Many electric and gas utilities would do more to help their customers save energy if they found it profitable to do so. Unfortunately, in most states outside of California, utilities' profits are tied directly to the amount of

electricity they sell. The National Association of Regulatory Utility Commissioners supports this decoupling of profits from sales volumes. Still, in most states, no financial incentives exist for rewarding utilities that do an especially effective job at helping their customers save energy. What remains is for the Congress to put this issue on the state utility commissioners' agenda; to give them two years to bring it about in the way they see fit. Senator Wirth's bill to combat global warming proposes to do just that, and deserves the support of this committee.

7. Though Clean Air legislation allows us to reduce emissions of acid rain precursors inexpensively through improved energy efficiency, only $1 million is currently authorized for "least cost planning" technology transfer. President Bush's request for $3.8 million is better, but the $10 million proposed by Claudine Schneider is the minimum needed to make this an effective means of saving our air, our lakes and our forests.

8. 50 Simple Things encourages people to avoid products that contain ozone-depleting substances. So much confusion exists over the CFC content of food packaging that people don't know what to buy and what not to buy. People don't know which auto service shops recycle CFCs from air conditioners and which continue to vent them. The federal

government could aid this process tremendously simply by passing the stringent labeling amendments proposed in the House version of the Clean Air Act. Manufacturers seem quite eager to identify products which are "ozone-friendly." What's needed is a reliable, credible way to tell people which products still contain methyl chloroform, CFCs, carbon tetrachloride, and a handful of other ozone depleters.

9. 50 Simple Things gives ample encouragement to consumers to recycle paper, glass, aluminum, and many other household items. Curbside recycling is booming in America, though the federal government is still in the pilot stages with its internal recycling programs. Why is the federal government lagging behind the efforts of its own citizens? Not only should government buildings recycle all of their paper, glass, and aluminum (to save taxpayers money from disposal costs if nothing else), but they should be pro-actively purchasing products made from recycled materials. Furthermore, the government should reexamine its archaic standards for the whiteness of paper, which cause excessive bleaching of pulp that yields the deadly byproduct dioxin.

10. 50 Simple Things alerts people to the presence of hidden toxics in produce, meat, household cleaners, pet collars, and other seemingly innocuous places. Even though organic produce is slowly making its way into America's grocery

stores, consumers still lack the information to compare it with "traditional" produce. The government, as custodian of national health, should require that all produce and meat be labeled with the pesticides, fertilizers, synthetic hormones, and other artificial chemicals used in their production. The goal is simple: don't tell Americans how to eat, but make them aware of what they eat everyday without knowing it.

Other witnesses at today's hearing will, I am sure, have more items to add to this list. The point is not to recite a litany of failed or delayed federal policies, but rather to emphasize the positive. That's the beauty of the 50 Simple Things book -- it has everything to say about solutions and almost nothing to say about blaming someone for the failure to act before now. The time is right to begin anew, and millions of Americans await your leadership by example.

Thank you.

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Senator GORE. Thank you very much.

Again let me interject a brief note. The recycling idea you mentioned is contained in legislation now pending before this committee, and we will be hearing more about that as time goes on.

Let me now welcome again John and Kathy Dewey and their children Brad, Molly, and Ben. We are really looking forward to your testimony. Dr. Dewey, how do you want to proceed?

STATEMENT OF DR. JOHN DEWEY; ACCOMPANIED BY KATHY DEWEY, BRAD DEWEY, MOLLY DEWEY, AND BEN DEWEY

Dr. DEWEY. I think we could probably proceed with Kathy and then proceed to the children and I will finish.

Senator GORE. Okay. Mrs. Dewey, welcome.

Mrs. DEWEY. Thank you.

My name is Kathy Dewey and I am here representing the home front to tell you what I do at home and how we try to recycle and take care of things the best we can.

We began recycling newspapers three and a half years ago, number one because we liked the idea and, number two, because the Boy Scouts at our church were using that as a fundraising project and it gave us a place to take them. After that, we found out about an aluminum can recycling fundraising project at the Northern Virginia Training Center for the Mentally Handicapped, which is near us. So we started taking our aluminum cans over there.

Then the next step just came about sort of naturally, another bag in the kitchen for the glass bottles. And now, when those bags are filled up we take them to the garage. Then about once a month we go to the recycling bins at Wakefield Recreation Center, which is a Fairfax County facility.

Usually John or I will go and take the kids, and they enjoy doing it. It is kind of a treat. It is a little outing to go to the recycling bins.

We would be willing to do more. We drink a lot of milk. We have plastic milk cartons. We do buy aluminum canned soft drinks and those kind of things, since we can dispose of them properly.

But we get magazines. We have scrap paper, tin, and other aluminum products that we would be more than willing to do something with besides put them in our garbage can. But right now I do not know exactly where we could put it.

I think more people would be willing to recycle. We have talked to our neighbors, and if there were collection points that were accessible I am sure that all of us would. And maybe if there was a demand for recycled products, there would be more collection points.

I would like to thank you—I know you did a lot for Earth Day—and applaud all of those that did get out all the literature to educate us in honor of Earth Day. I have since gotten enough courage to refuse plastic bags from retailers, which was kind of fun. I have ordered string shopping bags to carry the groceries. And—this was really hard for me—I have put the dishes in the dishwasher without rinsing them first, and nothing happened. I mean, they got clean and everything.

We switched back to cloth napkins, which was something John and I had done for years when we first got married and got out of the habit with little babies. But we are doing that again.

We are composting grass clippings. We live in a very neat suburban neighborhood and there are certain little rituals. I think people will start behaving more responsibly as far as their yards go if they are made aware of the dangers.

At this point, I am not willing to give up all of the conveniences that I have come to enjoy around the house that may not be environmentally safe, like plastic bags. But I am starting to become more aware of my choice and to check for an alternative first.

I have many questions about individual household products and their alternatives, and I have found some books recently that I have started to refer to that have some answers.

I carpool frequently, but I will admit that it is for my own convenience a lot of times as well as just to keep an extra car off the road. The kids are just becoming old enough for me to let them walk to school or to a shopping center, but right now, we live on Braddock Road and there is a lot of construction there and I do not feel that it is safe to let them walk right now.

We do not use public bus transportation because we are not familiar with it and have had no experience with it in the past. But we do use Metro and are very comfortable with the Metro, as long as we can drive to the station.

So far I have done only little things, but I am much more aware now of what else I can do. I want manufacturers to recognize that women like me do not shop blindly, that I am capable of choosing their product over another if I know that they use recycled paper in their packaging or if they choose not to use any packaging at all if it does not need it.

We have always tried to do our share, but I realize that a little more effort may be needed to make a real difference. I think that in six months you will see that we have tried harder and we are better.

I would also like to recognize my father-in-law, Ed Dewey, who is in the audience, and he has been a wonderful role model to us. From stories I have heard from long before I met my husband, he has cleaned up ponds, and whenever we have gone on vacation to beaches he always has a bag with him for picking up trash on the beach.

He recycled as a restaurateur in New York even though he got no support from distributors. He's always done it, and I just would like to thank him for being a good role model.

Thank you.

Senator GORE. Great. Now, Brad, Ben, Molly, who is going first? Bring that microphone over and get it close enough to you so we can hear you, just like your Mom.

Mr. BRAD DEWEY. Hello. My name is Brad Dewey and I am a student at Robert Frost Intermediate. I, along with my peers, have been trying to form recycling initiatives to do our part in saving the environment. We also have been making signs and posters to advertise the problem by using original phrases and even popular characters like Bart Simpson.

However, even with the immeasurable help of the school staff, we still have met many drawbacks. We still keep on trying and hopefully we will reach our ultimate goal of recycling in the school.

We are being taught the effects of both air and water pollution to the environment and from what I have been taught I do not like what the government is letting industry get away with.

In my opinion and also most children my age, I think that if something is not done now we will not have a clean place to live, work and play when we lead the country. It is possible that there will not even be a place at all that we can live, work and play when we are old enough.

We are trying to do our part, but we need help from you, as well as action.

Thank you.

Senator GORE. Okay. Who is going to go next?

Now let me say, Brad is 13 years old, Molly is 11 years old, and Ben is 10 years old.

Okay, Ben.

Mr. BEN DEWEY. Hi. My name is Ben Dewey and I am in fourth grade. But I am not just a regular old kid; I am a kid that wants to recycle. So I am going to talk to my principal and see if we can get two trash cans in each of the rooms, one for any kind of recyclable paper and the other one for just regular trash.

That is all I have to say. And since I am a kid and we might live longer than some of the grown-ups, I wanted all the grown-ups to help out so this world can be a better place that we live in.

Senator GORE. Bingo. That really said it all. Good job, Ben.

Molly.

Ms. MOLLY DEWEY. Hi. My name is Molly Dewey and my point on recycling and saving the Earth is that we are the children of the upcoming generation. And I talked to a lot of children in my school about what they think about saving the environment, and I think us children have a lot of interesting things to say.

I decided that when I become older I will encourage my children, relatives, friends, and neighbors to recycle and save the environment in any way possible. I also decided to take a poll of how many students and teachers either do or like the idea of recycling. I have collected exactly 181 names, almost half the school, Old Creek Elementary.

Senators, would you like to see my list?

Senator GORE. Yes.

[Pause.]

Senator GORE. Are these your classmates? The whole school, these are from the whole school?

Ms. MOLLY DEWEY. It is as much of the school as my teacher would let me get.

Senator GORE. It is entitled "Children at Old Creek Elementary School who like the idea of recycling," and you have numbered them all and they have all signed. And you have got 181 signatures of children at your school who like the idea of recycling.

We have one more witness on this panel. Dr. Dewey.

Dr. DEWEY. Yes. Thank you, for inviting us here today.

I think it is apparent that we are a very average family from the Northern Virginia area. Kathy and I have been really what you

could refer to as apolitical. We have been uncomfortable with taking strong stands and political action in the past, and just have preferred to act in a manner that we feel is responsible and let others do the same.

I have three points that I would like to put forward at this point that I think are relatively simple. The first is that while following the press I tend to see both sides of ecological arguments presented very forcefully, and then I see what appears to be the selective use of information to support their views.

What I do not see is any acknowledgment of uncertainties or any kind of balanced viewpoint that allows for what we know and how specifically we know it. I think that the government could provide a great service by giving us some authoritative voice on exactly how much has been documented, how well documented, and how serious the impact. This is especially true of the larger issues of ozone depletion and global warming.

To get down to the better known examples, I think that I would like what I refer to as an effort impact analysis done. Certainly in business everybody is aware of their cost-benefit analyses. In medicine we have risk-benefit analyses. And I think in the ecology movement there would be great value in an analysis that tells us how great the impact on the environment for the amount of effort that the average consumer puts into any kind of recycling effort.

I have no idea on my own as to whether I am doing more by recycling newspaper or tin cans, and I think that that kind of information will allow us to sustain the effort that John has so nobly generated with his books.

Certainly as the number of simple things you can do rises from 50 to 1,000 to 5,000, at some point in time we are all going to find that we simply do not have enough time and energy to do all of those things, but that if we could know those that are the most effective and compare them to how inconvenient or convenient they might be in our own personal lives we would be able to make our own judgments.

The third point I would like to make is that I recognize that the legislatures of the Federal and State governments hold in their hands an extraordinary power, a force that probably is unparalleled in America, and that is the people's desire to avoid taxes.

I would propose that we consider the equivalent of a sin tax on environmentally dangerous materials or those that have an adverse impact. I would like to take an example from the health industry and propose that we place the tax highly visibly on the product, just the way the smoking warnings are found on cigarettes.

I would like to have it read something like: The price of this aerosol product is $1.04; the price of the tax for the presumed cleanup of the hazardous ingredients is 35 cents, and so your purchase price is $1.39.

By being very visible at each point of choice for the consumer and earmarking the funds towards the proposed cleanup of toxic chemicals, we could put the issue in front of everybody every day with every purchase.

Finally, I feel that as a physician that public transportation is not realistic. I do not think my patients would understand that I had to wait for a bus when they were in a medical emergency.

But I do feel that there is some hope in the use of electric cars. Certainly I followed the recent race that was held in Australia for electric-powered cars with some enthusiasm, and I really welcomed the article in the Post last week of GM proposing to produce an electric car.

There are two things I would like to say about that. For an energy efficient electric car to do its job, it would have to be very light, and that in and of itself is not a problem for me. Where the problem lies, in the basic physics of automobile accidents.

As an orthopedic surgeon I have watched my patients go from not surviving a car accident with no protection, to being paraplegic from lumbar fractures with a seatbelt alone, to becoming quadriplegic from using a lapbelt and a shoulder belt. It has not been until we have used airbags that I have seen a plausible way of avoiding serious disability associated with bad auto accidents.

I myself drive a car that has an airbag and I am perhaps politically active in that regard.

So with respect to an electric car, I would urge that we stress to the industry that electric cars should be provided with airbags to protect the occupants from the obvious difference in curb weight, which would lead to them absorbing all the energy of an impact with a larger car.

Finally, I think that electric cars are useful only to the extent that they really totally avoid the use of petroleum-based fuel, and that even if it only saved the energy associated with a mile or two I would feel substantially better if my electric car had a photovoltaic cell on the roof or the hood, so that I could feel that truly some energy was saved and that the impact was not simply limited to fewer fumes.

Once again, it is a great honor to be invited here and I look forward to the question and answer period. Thank you.

Senator GORE. Thank you very much, Dr. Dewey. I am certainly impressed with your family. I say this to you also, Mrs. Dewey, and all of the statements you made were really very, very helpful to us.

I get the impression that there are millions of families who feel very much as you do about wanting to do something to help save the environment, and they are willing to take some steps and have already started to do what they can. But one of the things I think you are telling us today is that the marketplace is a little confusing and it is hard to know where the right products are, what steps are most protective of the environment, for a family like yours it would be very helpful if the government could take some steps that would clarify for you which actions are most helpful and make it easier for you to do even more to protect the environment.

That is part of what you are saying; is that fair to summarize it that way?

Dr. DEWEY. Yes, quite accurate.

Senator GORE. Okay. Let me take a couple of examples that Mr. Javna and Mr. Calwell used. This flow restrictor—what do you call that?

Mr. CALWELL. Actually, no. The flow restrictor would be a device that you put inside an existing shower head, that tends to hamper its performance and cause people to curse the fact that energy efficiency was ever visited upon them.

This is a low-flow shower head.

Senator GORE. Low-flow shower head, which you think is a much better approach than that old flow restrictor.

Had you all heard of that?

Dr. DEWEY. I have had some unpleasant experiences with flow restrictors in hotels.

Senator GORE. Okay.

Dr. DEWEY. And so this seems better. But no, we had not heard of it.

Senator GORE. You had not heard of this device. I wonder why it is not better known.

Mr. JAVNA. That was a question that we asked when we first discovered it. Chris knew about them, but I had never heard of one when we started doing the book.

There is something else about these shower heads, which is there are shower heads which are substantially better than others. The most available are the worst. The ones I can get at my local Ace Hardware Store in Berkeley, California, are pretty pathetic. They cost ten dollars and they are not worth it.

This is, for 14 dollars, it is not available in any store, even in Berkeley. I know it is not widely available throughout the country. Why? Nobody is asking for them. I guess there are not enough people demanding them, and that is probably because people do not know they exist.

Senator GORE. Well, maybe you need to do another book on which products are best.

Mr. CALWELL. Two points actually. First of all, some catalogues are beginning to come out that offer the products directly to people. And John is I think doing an admirable job of publicizing the existence of those catalogues to people so that they can order the products direct, even if the hardware stores have not gotten on the wagon yet.

Secondly, one of the things we are trying to do at NRDC right now is begin a study on the West Coast that compares the performance of different low-flow shower heads in a utility setting, so that utilities, rather than simply letting out a bid for the least expensive shower head that can be provided, which is likely to be made of plastic, would instead choose a shower head that they know people are likely to use. Therefore, the energy savings would not just be on paper, but would be real.

Senator GORE. Now, what about, Mrs. Dewey, you saw that lightbulb that Mr. Calwell held up. It costs significantly more than the regular kind, but it lasts 13 times as long and saves energy. Had you all ever heard of that?

Mrs. DEWEY. No. Just about a week before all the Earth Day festivities we received a catalogue in the mail from Seventh Generations, which is a group that sells recycled products or products made from recycled paper, and we ordered a set of ten of the globe type, as opposed to this tubular.

Senator GORE. Oh, so you already did order some of those?

Mrs. DEWEY. We ordered them, but they have not come yet.

Senator GORE. Well, maybe a lot of folks are right just on the edge of making that choice.

I think that one is one that can really take off quickly.

Mr. CALWELL. Actually, when I spoke to the Department of Energy about it two years ago, the gentlemen told me quite candidly that he did not really care about the energy savings, because the savings in not having to send people up and down the ladder changing bulbs far outweighed any other monetary savings they could get on the energy side.

Senator GORE. Let me ask you a little bit more about recycling, Mr. Calwell. Just review very briefly what you think the Federal government ought to do to make it easier for families like the Dewey family to recycle more effectively and to help create markets that would make it possible for the whole country to recycle more effectively?

Mr. CALWELL. Okay. I think that is a two-part answer. First of all, I live in San Francisco, or actually in Berkeley, where curbside recycling is fairly common. And I understand from talking to my colleagues here in Washington that it is much more difficult to recycle.

You can perhaps toss the things in your trunk and take them to the grocery store, but no one is going to come by and make it easier for you to do it.

Senator GORE. Well, the Dewey family, if I can interrupt briefly, excuse me, you recycle newspapers through your church, is that right?

Mrs. DEWEY. No, the Boy Scouts stopped doing that. So we kept recycling them, but we carry them now to Wakefield.

Senator GORE. To?

Mrs. DEWEY. Wakefield is about four miles away and it is a Fairfax County recreation center, but they have recycling bins in the parking lot.

Senator GORE. And you take your newspapers and your cans to the same place?

Mrs. DEWEY. And the glass, yes.

Senator GORE. And the glass. What about plastic?

Mrs. DEWEY. I do not know of any place around in Northern Virginia that accepts it.

Senator GORE. Okay.

Excuse me for interrupting, Mr. Calwell.

Mr. CALWELL. That is okay. What the Deweys have pointed out, obviously, is that in some cases, unless government, whether that be local, State or Federal, unless government helps you with recycling you might find yourself in the situation where you use more energy transporting the recyclable materials to a grocery store than might ever be saved when they are recycled.

Government clearly can act there to make it easier by simply taking advantage of economies of scale.

The other point I would make, I think, given the statistics you yourself quoted about Federal use of paper, is that it is far more important that the Federal government buy materials recycled from thrown-out materials than it is for the government to recycle itself, because I do not know if it is found to be the case on this

coast, but certainly on the West Coast incidents have been documented where recycled materials piled up and were awaiting a buyer.

Senator GORE. Right.

Mr. CALWELL. And no buyers existed and they were sent to a landfill.

So I think John has quite admirably engaged people in the business of recycling their own stuff. Now we simply need to go out and create the markets.

Senator GORE. So the Federal Government could jump into that business. I saw an article in the New York Times business section last week analyzing the difficult decisions which now have to be made within the paper industry. All these companies are sitting around scratching their heads, wondering whether or not it makes sense for them to invest a lot of money in new mills that recycle paper.

The one question they are trying to answer is, will this last? Is the surge in demand for recycled paper a fad or not? They are really trying to read the minds of the Dewey family and figure out whether or not they, the paper industry, will be able to make money if they invest now in recycling technology.

If we take your advice, Mr. Calwell, and pass a law that says the Federal government has to start purchasing more and more recycled paper each year for its needs, then that will send a very powerful message to the paper industry and to other industries facing similar decisions on recycling investments and kind of get the ball rolling. And then the Dewey family will find it easier to locate recycled products in the stores.

They are out there looking for them actively right now, and when they become more available then the same surprise the publishing industry registered when Mr. Javna's book sold out will come as recycled products begin to sell out relative to their nonrecyclable competition.

That is my prediction, listening to what Ben said, "I am not just a kid, I am a kid who likes recycling," I really think that we are seeing a very profound change in attitude. And all these industries are going to find that out, I think.

I have got a lot of other questions, but I am going to hold off. Let me just say again, we have legislation on recycling markets that I hope we will be hearing a lot more about, because it really takes the approach that you are recommending.

Senator Pressler.

Senator PRESSLER. Thank you.

I have a question for Chris Calwell. As you pointed out repeatedly and as has been evidenced by your book's popularity, Americans are greatly interested in taking steps to help the environment. However, one problem we face is the fact that many of these energy efficient items are hard for consumers to find.

How do we find them and how do we make them more readily available?

Mr. CALWELL. Actually, one proposal I have been turning over in my hands, if you will, is that, in the case of compact fluorescent lightbulbs, a conference be convened, at least on the West Coast, although it could certainly be a national conference, where people

who have good ideas on how to get compact fluorescents into homes meet with people who manufacture them and people who operate utilities, and that the three key players exchange information.

Perhaps we would also want to invite people who do ordering for hardware stores. The result being that, rather than coming up against barriers again and again and again, successful proposals like one in Massachusetts, where the bulbs are leased to people on their energy bill for 20 cents a month, thereby overcoming all the purchase price objections, those ideas could become more broadly disseminated to the rest of the country.

But the short answer to your question is, the utilities and the commissions that regulate them are a powerful tool for that in the case of the energy arena. It is much harder in some other areas, but the energy devices seem to be among the more difficult to find in stores.

Senator PRESSLER. Thank you.

Mr. CALWELL. If I might mention one other program that John correctly reminds me of, in the State of Maine, Central Maine Power finally decided that the only way to overcome it was to take them to people's doorsteps, and they purchased 100,000 of the bulbs at a very low per unit price, contacted a charitable organization that typically sells other types of items door to door, and gave the bulbs to those people for three dollars instead of 15.

They in turn were able to resell them to people and make a little bit of money for their charity, and essentially 100,000 bulbs sold out in the State of Maine in a period of two weeks.

Senator GORE. Senator Bryan.

Senator BRYAN. Thank you very much, Mr. Chairman. I would like to preface my remarks by congratulating you for your leadership in holding this hearing and giving a lot of us the extraordinary opportunity to meet a remarkable family, the Dewey family. I thoroughly enjoyed hearing from Dr. and Mrs. Dewey and the children this morning and hearing from our distinguished authors.

If I might ask the Dewey family, could you give me your sense of how far your neighbors are prepared to go in terms of doing some of these environmentally positive things that we all acknowledge are helpful?

Those of us who serve in the Congress and who are here every day live in a very isolated environment. I think it is unreal. It is probably far removed from the reality of suburban living here in the metropolitan Washington area or even in my own home State back in Nevada.

Give me your sense as to what level of interest or commitment you see among your neighbors, people that you shop with, go to church with, are involved with socially, or talk with, neighbor to neighbor?

It looks like you have been appointed, Mrs. Dewey.

Dr. DEWEY. Let me defer to my wife. She seems to know a lot more about the neighbors.

Mrs. DEWEY. I do think that the recycling, the three items that we recycle, there seems to be very little effort on our part to take care of those.

The lawn is the big problem, because everybody is so particular in the suburbs about their manicured lawns, and we have not

really worked through all of that ourselves. We have a new subdivision and the trees were all plowed to build the house. People are beginning to plant trees, but I do not know if they are doing it for the look of the trees or if they are thinking about the air quality when they plant them.

We do talk about it when we get together. Like I said, we have not really decided what we are going to do. We have a lawn service that I feel is one of the better of the existing lawn services. They do not spray at random and they use granular instead of liquid.

We have not really worked through that ourselves, because I do not know how some of the neighbors would feel if our lawn had little brown spots and big patches of clover and theirs was nicely manicured. They might feel like we were affecting their property values.

Senator BRYAN. Mrs. Dewey, I sense that your neighbors do not have the level of commitment that you and your family have in terms of going four miles to Wakefield, wherever that is, to deposit these items. But would there be a sufficient groundswell of community interest, led by people like yourself and others who are not only concerned but are prepared to do things, to get local ordinances to require recycling?

Mrs. DEWEY. I think that would be wonderful if people are required to do it—it is just a bad habit to get into of just throwing the stuff away. You know, it is very easy just to put it in another bag. And I think people, even if they complained for a week, they would get over it. There are other things they can complain about.

Senator BRYAN. Well, recently the District of Columbia required recycling of newspaper. And I must say, it is really not much of an inconvenience. You keep the newspaper separate someplace and then it is picked up with the periodic trash pickup. That really is not difficult.

On the other hand, if you are asking people to travel ten blocks or four miles and drop it off, I do not think that is likely to occur. I think people like yourself ought to be commended, but I think that you are the exception rather than the rule. Not too many people in the country are going to go four miles to drop off these recycled products, as you and your family do.

So it strikes me that maybe there may be a role that you might choose to carve out for yourself, to be molders of public opinion in your own community, maybe to get ordinances in your area to require recycling and to make the pickup stations available so it is more convenient for everyone.

Mrs. DEWEY. I did fail to mention that we do have newspaper pickup. We have private garbage collection and they raised their rates a little bit so that they would make an extra trip and pick up the newspapers. But I usually forget to put it out and take it with the other stuff.

Senator BRYAN. Is that required by ordinance in the community in which you live, that people must recycle newspapers?

Mrs. DEWEY. Yes.

Senator BRYAN. So it is part of the pickup. Good.

If I might ask our distinguished authors, the chairman mentioned the confusion in the marketplace in terms of labeling, and I think he is right. I think most people are trying to do the sensible

thing environmentally. They may not be people that would describe themselves as environmental activists, but if given the choice between product A and product B, both of which accomplish the purpose that the product is designed to accomplish, would choose the more environmentally friendly or responsible product.

What I apprehend, however, is that there is a lot of cynicism out there in the public. You know, we had one major seller of these trash bags saying: Look, ours are biodegradable. I think people did respond and say, yes, I need a trash bag to pick up lawn pickings or whatever it happens to be around. But then it turned out that in point of fact that was not an honest representation. And subsequently the company withdrew that representation or labeling.

My point being, if we are going to get some environmental labeling, it has to have credibility. I think the public, having been led down the primrose path, is likely to say: Well, how do we know this is not just another marketing tool and in point of fact all we are doing is enhancing a product line's sale, as opposed to doing something that is responsible for the environment?

Give us some direction as to how we might frame those guidelines, if you think it is appropriate for the Federal government to be involved and how we go about that?

Mr. JAVNA. You are expressing a concern that a lot of people in the environmental field are expressing right now. There is a lot of deception right now. And as people become more concerned about what products are or are not environmentally safe, which is by the way a marketing term about the equivalent of "Have a nice day," environmentally safe, because no product is completely environmentally safe.

As people get concerned about making choices like that, they look to labeling. And labeling is just advertising hype and advertising hype will say whatever it wants to in order to get people to buy things.

We are starting to see that quite a number of companies, sensing a trend, have started to promote their product as environmentally sound. And the public cynicism is well-founded, and a lot of it is just hogwash.

It would be wonderful if the Federal Government could apply some sort of truth in advertising laws to ecological statements or claims also, perhaps give some meaning to words like "biodegradable," legal meaning to words like "biodegradable" and "organic."

Senator GORE. Environmental President.

Mr. JAVNA. It would be nice to have a meaning to that, too.

There are also words which are used which I suppose are legal to use, but which it would be nice to see be restricted, words like "recyclable" or words like, well, as I say,"biodegradable." Everything is biodegradable eventually, even plutonium if you have a few million years to wait.

Senator BRYAN. We know about that out our way.

And we are not real enthusiastic about it, I might add parenthetically.

What I am trying to ascertain, and I appreciate the candor of your response, is can we frame labeling legislation or regulations that do in fact make an honest representation as to the content of the product and give the concerned buyer an honest choice, so that

he or she knows that if they choose this product over another one, they are making a choice that has a positive environmental impact?

I think all of us would like to see that. My question is can we do it, and if so how?

Mr. CALWELL. Let me give one pointed example, which is taken from my written testimony. There are as I understand it in the House version of the Clean Air Act some fairly stringent labeling requirements on the content of ozone depleting substances in commercially available products, and manufacturers already seem quite eager to identify products that are ozone friendly.

Senator BRYAN. Yes.

Mr. CALWELL. That is not a problem. But what is a problem on the other side is products that continue to contain ozone depleting substances certainly do not call attention to themselves. And the Federal government knows what the atmospheric lifetime of the chemicals are. They know what the ozone depleting potential of the chemicals are. They know a lot of numbers which would not make any sense to people, but it could be brought down to one scale that says, it is a universal warning: This product contains substances that deplete the ozone layer, and on a scale of one to ten or whatever per serving size, per dose, it is an eight, you know, it is really bad, something like that.

It is an oversimplification, but you understand how it might work for one specific type of product.

Senator GORE. If the Senator would yield briefly. The legislation to which I referred earlier on a national recycling policy and recyclable commodities includes a section on what is fair and unfair in terms of labeling something recyclable, how recyclable is it, et cetera, et cetera. I think it is really needed, because it is disappointing for a family like the Dewey family if they are misled by some marketing pitch when something is said to be recyclable and really it is not.

So I think really the argument is very strong for this committee to step in and set some standards like that.

I appreciate my colleague yielding, and if you will take the chair briefly, I have to step out.

Senator BRYAN [presiding]. I will do so, Mr. Chairman.

Senator Kerry joins us, one who has had a long interest in environmental issues. Let me defer to him for some questions if I may. Senator Kerry.

OPENING STATEMENT BY SENATOR KERRY

Senator KERRY. I am not sure that I have a great many questions. I want to welcome the members of the panel.

I would like to congratulate the Chair in absentia on holding this hearing, which I think is important, particularly in the wake of Earth Day and the need to really create practical outlets for the enthusiasm and the energy that was pulled together on that particular day.

As a participant in the first Earth Day 20 years ago and as chairman of Earth Day New England this year, I have a 20 year perspective and have a sense of the difference between those two cele-

brations. I thought that Earth Day this year was significant on a number of different fronts.

But what particularly struck me was an article today in the Post by Bill Raspberry. The title on it is "How Earth Day Failed." He suggests that there is something either cosmetic or symbolic about it, but that individuals are not really going to make the difference. And he says right here, and I quote him:

> Nothing individuals can do will cut back on the oil spills that lay waste to some new stretch of beach every year, reduce the acid rain which is killing our streams, substantially reduce the exhaust fumes fouling the suburban air, or lift the industry-spawned pall over Eastern Europe.

I am absolutely dumbstruck, flabbergasted, and astonished by such a comment. It ignores what the first Earth Day created, which was nothing less than the EPA, the Clean Air Act, the Clean Water Act, and the Superfund. And it totally denies the whole notion of individuals banding together to make a difference through the life choices that they make, which is what this is about.

It is almost so wrong on its face that it is hard to find the examples that are necessary to try to combat it. But obviously, it is like the civil rights movement—where one person named Rosa Parks made a huge difference by deciding not to go to the back of the bus—or a guy named John Lewis, who is now a Congressman, who marched across a bridge knowing he was going to be beaten up on the other side—in order to make a difference.

Lech Walesa all alone jumping over a fence to join a strike without any real idea about what it was all about and becoming the leader of a movement that has inspired millions of people is an example of an individual making a difference. Gaylord Nelson, who wrote the first letter saying, we need to have an Earth Day, and Dennis Hays dropping out of law school to go help put it together. They made a difference.

It's just wrong to suggest that it is not important for people to begin to make personal choices which affect the products that will be made. If people are not buying products, then companies are going to begin to think about making products that they will buy. And if people begin to change their lifestyles in a hundred different ways, then they give support to their neighbors and friends that this is not just a fad or something, but it has practical meaning in everybody's life, as the Deweys can attest and are here to attest.

So I really just am realiy struck by how Earth Day was a success before April 22nd. Earth Day was a success before anybody appeared at any rally around the country. And the reason I say that is that I know what we did for months preparing for it.

Countless communities made decisions to recycle. Countless communities conducted audits of institutions in those communities to determine their energy conservation capacity. We put into countless schools thousands of programs, curricula for kids K through 12, which made those kids ask questions they had never thought of asking and gave them a consciousness about fluorescent versus incandescent lights, about all kinds of food purchases and other kinds of things.

I have long been screaming about the packaging on compact discs, and I held up a compact disc once at a hearing and said: What the hell are we doing? Half this thing is empty; it is crazy. Today I noticed an advertisement in Rolling Stone, a bunch of artists and people out in California who are suggesting that we ban the box in which compact discs are packaged. That, it seems to me, is an example of individuals making a difference.

I want to applaud the Deweys and the rest of the participants here for having persevered and for setting an example and making these kinds of choices, which I think are absolutely critical.

I would like to also call the attention of the committee to an excellent article by the chairman, Senator Gore, who I thought wrote a tremendous article on Sunday, which appeared in the "New York Times," as a rebuttal to the current posture of the White House on the subject of global warming.

Mrs. Dewey, you are here to testify with your kids about these choices and your family. I would like to just ask you, How do you react to an article like the one by Mr. Raspberry? What do you think we should do in response?

Mrs. DEWEY. It is really frustrating, because you feel that with all you have done, even though it has not been a tremendous effort for us—it was not worthwhile. You feel like you are really helping, and then they just kind of kick you.

But I think—this is not really your question, but can I say it anyway?

Senator KERRY. This is one of those question we call a softball, where we give you a chance.

Mrs. DEWEY. I do think that the school systems should allow the kids to recycle things. I know that in Brad's school, in the junior high, they have a little more freedom in what they can get for lunch and they have a machine with cans of juices in them. There is a separate place for cans, but it is not very obvious where everybody can find it, and the kids end up just throwing it in the garbage.

I think if the younger people get in the habit of separating these things, they will get home and do it. It is almost painful to go somewhere where you cannot put your glass bottle in the right place, you know, and you have to throw it in with just all the other stuff, and you go, ugh. It is kind of like getting in the car and forgetting to put your seatbelt on now, we are so used to wearing them.

But I think the kids ought to be encouraged in places where they spend so much time, in the school. They ought to be encouraged and the habit should be formed with them.

Senator KERRY. Early on.

Mrs. DEWEY. Yes.

Senator KERRY. Brad, do you want to say something?

Mr. BRAD DEWEY. Yes. At my school we were trying to set up a paper recycling, which obviously we have an abundance of, and, well, as my mother said, they kind of kicked us there because they said that somebody could just walk along, light a match and toss it in.

But what is the difference between that and having paper in the trash cans? And now we have been trying and there is not much

that they will listen to us about. We have used that example and they say we are just not going to let you.

If we did do that it would be just an incredible savings. There is so much paper that we use.

Mr. CALWELL. Senator Kerry, if I might add a written response to the colorful gentleman from the "Washington Post." One paragraph from the introduction to the original "50 Simple Things" book:

> Few of us can do anything to keep million barrel oil tankers on course through pristine waters. All of us can do something every day to ensure that fewer such tankers are needed. None of us can close the whole in the ozone layer above Antarctica. All of us can help prevent its spread to populated areas by reducing our use of CFC's.

Senator KERRY. I agree with that, except I go one step further. I think people can make a difference in keeping those tankers on course, if you want to know the truth. The way you do it is create the environmental movement of those individuals who come to Earth Day and those individuals who create enough pressure on politicians that we create systems of accountability which will really almost be fail-safe.

It depends how much we care about it, whether we are going to demand double hulls, whether we are going to demand Coast Guard systems of verification, whether there will be positive control of tankers just like we have for airliners. There are things we can do.

We are doing them right now. We have got a conference going on with respect to oil spills at this particular moment. I think there are things that we can do that go beyond that. To me that is the significance of Earth Day.

I think that people can stop oil tankers from doing these things. I think people can create a broader political accountability. So I would reach beyond it a little bit. I think it is a question of creating that movement that is so critical to us now.

Let me ask another question, if I can. I want to ask just two quick ones. I do not want to prolong this. But I might comment parenthetically, in Boston we expected 50,000 to 100,000 people at our event for Earth Day. That is what we prepared for. We had 225,000 people turn out, more people than have ever turned out on the Esplanade in Boston than at any time since the Bicentennial Fourth of July.

Normally, that Fourth of July celebration has 24 trucks of trash. These 225,000 people left only four trucks, and we left it cleaner than we found it afterwards. So these things can make an enormous difference, obviously.

I just wanted to ask the Dewey family if the changes in the quantity of your family's consumption have in some way adversely affected your quality of your life, so to speak, or your lifestyle? How would you respond to that?

Dr. DEWEY. I have not perceived any change in my lifestyle, and perhaps the reason is because the choices we have made we made quite willingly. I think that when you yourself choose to change the way you receive products, that any kind of negative impact on your lifestyle basically erases because it is your own choice.

Senator KERRY. With respect to your book, the one thing lacking is the question of population growth. You did not seem to touch on that. Can you handle these large-scale environmental problems if the population keeps growing the way it is? Is that not the inevitable sort of——

Mr. JAVNA. The reason that population growth is not mentioned in the book is because we made a very conscious effort to suggest things that were really possible, that we thought were not intrusive, and that we thought that people would respond to in a positive way.

This is, after all, a beginning. It is simple things that people who have not done anything before can do now. And we felt that opening the door was important and not throwing out too much and challenging people to the point where they would just get overwhelmed, as they are already overwhelmed.

Senator, if I could just comment, something about the Washington Post columnist's words. The environmental movement as it exists right now, with people like the Deweys kind of giving it strength or starting to give it strength, is very tenuous.

The people who are hardcore, who are committed already to the environment, to the environmental movement, are not going to be swayed by anything that Mr. Raspberry says or that Mr. Samuelson in Newsweek says. But people who are tenuous, people who are just kind of thinking that maybe it is in fact something that they can do, that maybe they should get involved in protecting the environment, are easily swayed by people who I consider reactionary to the new environmental consciousness.

It is really important, from my point of view as someone who has gotten about 10,000 letters from people telling me what they want to do for the environment or what they have done for the environment, it is really important that people like yourselves, who are in a leadership position and very visible and who are committed, make it known to the people who want to get involved, who are not yet but want to be involved, that there really is a benefit to recycling and there really is a benefit to being careful about what you buy and there really is a benefit to buying energy efficient cars.

There are too many people throwing out too many half-truths at this point, which are going to prevent the almost committed from becoming committed. And if you really care about that, it is a really vital thing that people in government can do.

Senator KERRY. Last question: Do you think that we should create an environmental consumer protection board that begins to separate the half-truths and try to deal with what is biodegradable and what is not? I do not want to get into the commercial side. I think there are groups that are going to be out there doing the Green Seal and the other groups on the commercial products basis.

But is there something there that we ought to be doing for an environmentally conscious consumers?

Mr. JAVNA. It is a very tough thing, because a lot of the questions about whether products are environmentally safe or not are really marginal. They are very difficult to legislate, because it is a perception sometimes, but not a fact.

But certainly when people make outrageous claims there should be something to prevent that. And there are "biodegradable bags,"

as Senator Bryan brought up as one example. I mean, it was basically just a blatant lie.

People should know that, at the very least, that companies cannot make sweeping statements that are untrue about their products vis a vis the environment and get away with it. I think that you foster a great deal of cynicism in the public if you allow people, if you allow companies to say anything they want to say and for people to know that their claims are unrestricted.

More than that, I suspect it is very difficult to legislate. Phosphate-free detergent is a good example. You can say that detergent is phosphate-free, but you really cannot say that it is environmentally safe if it comes in a plastic container.

So how do you label something like that, except as "phosphate-free"? You can also say that it is biodegradable, but that of course is the problem with a detergent that has phosphates in it. So labeling it biodegradable does not necessarily make it good.

So all these things are marginal and they are strictly a matter of consumer education.

Senator KERRY. Thank you, Mr. Chairman.

Senator GORE. Thank you very much, Senator Kerry.

Before we close this panel, I want to know if Brad or Molly or Ben want to say anything else? Have you enjoyed being here?

Mr. BRAD DEWEY. Yes.

Senator GORE. Did you get out of school today?

Ms. MOLLY DEWEY. Yes.

Senator GORE. Do most of your friends feel the way you do about the environment?

Mr. BEN DEWEY. Yes.

Senator GORE. They do?

Mr. BEN DEWEY. Most of them.

Senator GORE. What was it you said earlier about kids living longer than grown-ups?

Mr. BEN DEWEY. Well, some kids might live longer than grown-ups and I was just hoping that all the grown-ups can contribute to help all the kids and the grown-ups and everything to make this world a better place.

Senator GORE. Well, do you think that people who are older do not care as much about the future?

Mr. BEN DEWEY. Well, some people really care a lot about it and some people do not that much. Some people are just real lazy and just sit around.

Senator GORE. Yes. Do you think kids are more likely to care more about the environment?

Mr. BEN DEWEY. Well, some can and some can also be lazy.

Senator GORE. And some kids can be lazy, too.

Brad, you are anxious to say something.

Mr. BRAD DEWEY. Yes. You asked if we thought our friends thought the same way we do. Well, I think my sister's petition shows that.

Senator GORE. Yes.

Mr. BRAD DEWEY. Not to mention the fact she did not even get to finish. She was brought back to her class before she had time to finish.

And I was thinking that what my brother was probably trying to say is that we were going to live longer in the 2000's. We are going to be living then, and we are wondering if we can possibly have a good place to stay. If we do not, then who else can we blame?

Senator GORE. Right. Yes, I think that is real clear.

Molly?

Ms. MOLLY DEWEY. When I went into the fifth grade class to get some of the signatures, I asked them who likes recycling, the idea, or who does recycle in their house, and a lot of people raised their hands. And then when I told them that they could come sign a piece of paper stating that they liked the idea of recycling, I got run over. They knocked me onto the table.

Senator GORE. Really? They were really that anxious to do it? Wow.

Ms. MOLLY DEWEY. They all ran up.

Senator GORE. Do any of you know what the greenhouse effect is? Can you explain it?

Mr. BEN DEWEY. Well, it is when the cars, the cars' exhaust fumes go up and hurt the ozone layer and the bad rays from the sun come down and hurt people.

Senator GORE. Brad, do you want to add something to that? That is good, Ben.

Mr. BRAD DEWEY. Yes. And the carbon dioxide starts building up at the top of the atmosphere and traps all the rays and heat in. And I have been told from you that it is going to raise the temperature from three to eight degrees, and that is pretty dramatic if you actually mount that up.

Senator GORE. Yes.

Ms. MOLLY DEWEY. Every time when we have free time during our class when we have finished our work, we usually all sit at one table, me and my friends. And it just seems that every time we talk to each other, the environment and effects always comes up.

Senator GORE. Was that just around Earth Day or is that other times, too?

Ms. MOLLY DEWEY. It happened a little last year, but it started more this year.

Senator GORE. Well, that is really interesting. And I am impressed with the way you described the greenhouse effect. I think you all understand it a little bit better than the White House staff does, and I am going to send a copy of our hearing record over there so they can read it, because I thought you explained it really clearly.

I wish we could spend even more time with this panel. I have really enjoyed it. Mr. Javna, congratulations again on your fabulous book. It is really terrific, and I have got a feeling that you have got a few more books in you yet to come. Mr. Calwell, I thank you, and through you, all the others who have helped on the technical advice and gathering of information for this book.

The Dewey family demonstrates what a tremendous market there is for the empowering information that you all are giving people. And to the Dewey family again, I am really glad to have a chance to meet all five of you. I am real impressed with what you are doing and the way you express yourselves, we really appreciate your helping us out today.

Thank you all very much.

Our second panel is invited to come forward now: Dr. John Lyons, Director of the National Institute of Standards and Technology in Gaithersburg; Mr. Christopher Flavin, Vice President for Research at Worldwatch Institute; and Dr. John Andelin, Assistant Director of Science, Information and Natural Resources at the Office of Technology Assessment. And Dr. Andelin will be accompanied by Dr. Rosina Bierbaum and Dr. Howard Levenson, who are both senior analysts at the Office of Technology Assessment.

Gentlemen and lady, as you are coming forward let me welcome all of you. And Dr. Lyons, on a personal note, thank you for participating in Earth Tech '90. Your display there was the subject of much comment. We appreciate the work that your people did in preparing it.

The National Institute of Standards and Technology at the Commerce Department is responsible for providing technological assistance and developing standards for American industry and other Federal agencies and, as we will hear, has been actively involved in this area.

I introduced Mr. Flavin as a Vice President at Worldwatch, and of course they prepare the much-awaited State of the World Report every year.

Dr. Andelin is with OTA and oversees production of reports on a wide variety of science and technology issues, and is presently working on a study to determine which technologies and government policy changes would be most effective in combating global change.

I add, again on a personal note, that Dr. Andelin is a personal friend and we had a chance to work very closely together when I was on the House Science Space and Technology Committee. Dr. Andelin bears some of the responsibility for the pseudo-scientific statements I make from time to time. I am delighted to see you again, John.

We are going to start with you, Dr. Lyons. Thank you for being here. Please proceed.

Senator KERRY. Could I just interrupt?

Senator GORE. Surely.

Senator KERRY. I apologize. I want to apologize to the panel because I wanted to be here, but it is later than I thought and I have to go down to the White House for a ceremony honoring one of my friends from Massachusetts.

But I hope you will accept my apology for not being here to hear your testimony. But I will follow it in the record, and I appreciate enormously your contributions in this.

Thank you, Mr. Chairman.

Senator GORE. Thank you, Senator Kerry.

Dr. Lyons.

STATEMENT OF DR. JOHN W. LYONS, DIRECTOR, NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

Dr. LYONS. Thank you, Mr. Chairman.

I would like to acknowledge your role in Earth Tech. I went looking for you and saw you freezing to death up on the platform, pre-

siding over the ceremony. It was a very impressive exhibition indeed and we enjoyed participating.

I am John Lyons, Director of the National Institute of Standards and Technology. Advanced technologies can be an important factor in the reduction of our nation's pollution problems. Two of the most pressing issues today are depletion of the ozone layer and the prospect of long-term climate change.

NIST can and is making major contributions to the solution of these problems. We work with other government agencies to understand the extent and nature of these issues and with industry to develop the advanced technologies which are key to solutions.

We develop generic measurements and data that industry needs to develop in turn new products and processes in a broad range of mature as well as highly advanced technologies. Today I would like to discuss our work briefly in alternative refrigerants, energy conservation, atmospheric chemistry, and atmospheric monitoring, and I have a fuller statement for the record.

Senator GORE. Without objection, your full statement will be included.

Dr. LYONS. Thank you.

Chlorofluorocarbons or CFC's are the working fluids for most cooling equipment. They are used in automobile air conditioners, home refrigerators, building chillers, and storage refrigerators, as blowing agents in the production of foams and insulations, and as solvents and degreasers for metal parts and electronic circuit boards.

The Administration is committed to phase out the manufacture and use of CFC's prior to the year 2000, ahead of the requirements of the Montreal Protocol, and to replace them with new alternative refrigerants. Dupont, Allied, and ICI have also targeted the year 2000 for a complete phaseout of CFC production.

Environmentally acceptable alternatives to CFC's arecritical to U.S. competitiveness. More than 5,000 companies rely on CFC's to produce goods and services valued at more than $28 billion a year. There are more than 700,000 CFC-related jobs and more than $135 billion worth of installed CFC-dependent equipment.

NIST programs investigate and characterize alternative refrigerants that will not deplete the ozone layer, and we provide technical information to industry to help it improve the performance and efficiency of the equipment in which these fluids are used.

CFC replacement must be done with great care so that additional environmental problems are not created by there placements and energy efficiency is not lost. We have conducted extensive experimental measurements of key properties of proposed alternatives and have developed theoretical models which utilize measured data to calculate the properties over broad ranges of operating conditions.

We have incorporated this information into a special software data base which is being used in industry to design efficient new equipment and retrofit existing installations to minimize energy efficiency loss.

We documented a potential 30 percent increase inresidential heat pump performance over the use of conventional refrigerant, R-22, by using binary mixtures of environmentally safe refriger-

ants. We believe these results could lead to the use of mixtures of alternatives as replacements for currently used CFC's.

We conducted experiments showing a 20 percent decrease in cooling efficiency of one of the leading alternatives. This matched similar industry observations and led us into a cooperative research program to study enhanced heat exchanger surfaces for this refrigerant to attempt to overcome this deficiency.

Turning now to energy conservation research, standards used today by building designers and engineers for new residential and commercial buildings are based on NIST work. Under DOE sponsorship, we developed standard testing and rating procedures for central heat pumps, air conditioners, furnaces, boilers, and water heaters. The procedures are used to estimate the annual energy efficiency and cost of operation of the appliance. With this information, consumers can make informed choices about which appliance or equipment they wish to purchase.

Our current emphasis is on developing the procedures for new integrated appliances, such as space heating, boilers which also heat domestic hot water, and central heat pumps which use waste heat to provide domestic hot water.

We are developing laboratory test procedures to determine the dynamic properties of full-scale wall structures so that designers can provide better estimates of wall performance and prevent unwanted thermal losses. We are developing experimental techniques to determine the performance of foam insulation blown with ozone-safe refrigerants. We are also developing computer simulation programs to predict moisture migration within walls, information that can be used by designers to prevent moisture accumulation and attendant energy loss.

Under controlled laboratory conditions, we are gathering data on the optimum performance of lighting and air conditioning systems for commercial buildings. We developed design guidelines to minimize peak cooling loads and to reduce energy use in the commercial office.

We are also developing new laboratory procedures to test and rate computerized control systems for buildings.

Through our work in atmospheric chemistry, we have contributed to the basic understanding of the mechanisms by which CFC's breakdown in the atmosphere and catalyze the destruction of the protective ozone layer. We released a personal computer version of our chemical kinetics data base which contains 8,000 determinations of rate constants for approximately 2,000 chemical reactions. This data base will help facilitate the calculation of atmospheric lifetimes of greenhouse gases and their ozone depletion potential.

We also have several projects contributing to the monitoring of gases and particles in the atmosphere. NIST standards are used for the calibration of measurement systemsand equipment and as reference points for the national and international measurement communities. We provide approximately 95 standard reference materials for various atmospheric gases and for particles typically found in urban air and diesel exhaust.

In cooperation with EPA, we designed and built 14 instruments called photometers to measure ozone. EPA uses most of these instruments for their ozone measuring network to ensure accurate

and compatible ozone measurements. Canada's Ministry of the Environment uses one to calibrate their ozone measuring instrumentation, and another is the primary standard for two major European ozone measuring programs. More than 20 countries calibrate their ozone measuring instruments against the NIST instrument located in Sweden.

We can determine the source identification of pollutants through isotopic measurements. We can determine whether the pollution comes from fossil fuel, for example from vehicle emissions, or biogenic sources, such as wood burning. This information is useful in the regulatory area as well as for making decisions on taking necessary corrective actions.

In summary, Mr. Chairman, NIST has research and development activities in a number of areas important to the problems of global climate change. Thank you for the opportunity to describe some of these to the committee.

I would point out, Mr. Chairman, that I did not talk about our work on measuring the heat content of solid waste, nor did I talk about our development earlier of standards for recycled oil, but those are additional efforts.

[The statement follows:]

STATEMENT OF JOHN W. LYONS, DIRECTOR

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

Mr. Chairman and Members of the Committee. I am John W. Lyons, Director of the National Institute of Standards and Technology (NIST). I am pleased to be here to discuss some of the programs of the National Institute of Standards and Technology (NIST) which provide technical support to many of our nation's environmental and energy conservation efforts.

Advanced technologies can be an important factor in the reduction of our nation's pollution problems. The environmental issues that are of concern to the U.S. are also of equal concern to the rest of the world. Our nation's ability to develop these technologies may have a profound influence on our international competitiveness and balance of trade. Two of the most pressing environmental issues today are depletion of the ozone layer and the prospect of long-term climate change. NIST can and is making major contributions to the solution of these problems. We are not only working with other agencies such as NOAA and NASA to understand the extent and nature of these environmental issues, but we are also working with industry on the advanced technologies which are key to the solutions. In this capacity, we develop the generic measurements and data that industry needs to develop new products and processes in a broad range of mature as well as highly advanced technologies.

We are currently working with industry to provide the data and measurement support required to develop alternatives to chlorofluorocarbons (CFCs) and the equipment that can use them. We are a federal leader in research on energy conservation in buildings. We also carry out research, development and certification of materials related to atmospheric chemistry and monitoring. Our work in these areas is discussed below.

ALTERNATIVE REFRIGERANTS

The working fluids for most small and large-scale cooling equipment are currently fully-halogenated, chlorofluorocarbons (CFCs). CFCs are used in automobile air-conditioners, home refrigerators, large building chillers, and refrigerated storage; as blowing agents in the production of foams and insulations; and as solvents and degreasers for metal parts and electronic circuit boards.

There is scientific evidence that the chlorine from CFCs is a major contributor to the depletion of the earth's ozone layer; and that CFCs represent to 25 percent of the current greenhouse gas emissions on the atmosphere. The long atmospheric lifetime of CFCs allows them to reach the stratosphere, where the chlorine depletes the atmospheric ozone layer.

The Administration is committed to phasing out the manufacturing and use of CFCs prior to the year 2000, which is ahead of the requirements of the Montreal Protocol; and to replacing them with new refrigerants that have little or no chlorine and/or relatively short atmospheric lifetimes. DuPont, Allied Chemical, and ICI have also targeted the year 2000 for a complete phaseout of CFC production.

The need to implement environmentally acceptable alternatives to CFCs is critical to U.S. competitiveness. More than 5000 American companies rely on CFCs to produce goods and services valued at more than $28 billion a year. In addition, there are more than 700,000 CFC-related jobs, and more than $135 billion worth of installed, CFC-dependent equipment facing servicing problems and reduced efficiency. This is not to mention the need for a wide range of new equipment optimized for the use of the new alternatives.

CFC replacement must be done with great care so that additional environmental problems are not created by the replacements. Of particular concern is the loss of energy efficiency due to the replacements themselves.

The challenge is to identify and implement environmentally acceptable alternatives to the CFCs in a timely but judicious manner. To accomplish this, it will be necessary to understand better the ultimate effects of the alternatives on the environment, and to characterize carefully their thermophysical and engineering properties. These data will allow industry to design efficient new equipment and retrofit existing installations so that losses in energy efficiency and performance do not occur. CFC alternatives must meet stringent requirements with respect to chemical stability, health, safety, thermophysical properties, materials compatibility, and cost. The most promising replacements at this time appear to be incompletely halogenated ethane molecules with little or no chlorine, and mixtures of such compounds.

NIST is conducting research, with support from the Environmental Protection Agency, the Department of Energy and the Air Conditioning and Refrigeration Institute (ARI), to determine the thermophysical properties of CFC alternatives and to improve the operating efficiency of equipment using them as working fluids. The availability of this information, in the form of pc-compatible computer codes, will assist industry in maintaining and even improving their competitive position in the international marketplace.

Beginning in 1987, NIST scientists in the Center for Chemical Technology and the Center for Building Technology collaborated to identify 14 important criteria that must be met by the alternative refrigerants, and to conduct a comprehensive search of 860 industrially important fluids that could meet this criteria. The research confirmed earlier studies that the halogenated family holds the most promising alternatives. The NIST research won the 1988 Best Technical Paper in the Journal of the American Society of Heating, Refrigerating, and Air Conditioning Engineers, and the 1988 Edward Uhler Condon Award for distinguished publication at NIST.

Since then, we have been conducting research which includes extensive experimental measurements of key properties of the proposed alternatives. We have been developing as well theoretically based models which will utilize the measured data by computer to calculate the properties over broad ranges of operating conditions. Results of this work have been published and incorporated into a special software database now available through the NIST Standard Reference Data program. This database, called REFPROP, is being used in industry through a special distribution agreement with the ARI and its 170 member companies. This information will assist industry to design efficient new equipment and retrofit existing installations so that losses in energy efficiency are minimized.

We have also developed a laboratory breadboard refrigeration system which allows us to change system components. In experiments using this system, we documented a potential 30% increase in residential heat pump performance over the use of the conventional refrigerant, R-22, by using binary mixtures of environmentally safe refrigerants. We believe these results could lead to the use of mixtures of alternatives as replacements for the currently used CFCs.

We also conducted fundamental boiling heat transfer experiments of one of the leading replacement refrigerants and documented a 20% decrease in cooling efficiency. This matched closely the 18% decrease in cooling capacity observed by manufacturers, in the field, with the same alternative refrigerant. This has led us to organize a cooperative research program with leading heat exchanger manufacturers and researchers to study enhanced heat exchanger surfaces for this refrigerant in an attempt to overcome this deficiency.

It is the purpose of our programs to look at and characterize alternative refrigerants that do not deplete the ozone layer, and at the same time to provide technical information to industry that could help them improve the performance and efficiency of the equipment in which these alternatives are used.

ENERGY CONSERVATION RESEARCH

NIST has been a federal leader in research on energy conservation in buildings for the past twenty years. Energy conservation standards used by building designers and engineers today for the design of new residential and commercial buildings are based on NIST work. We are currently conducting research in residential energy consuming equipment, building thermal envelopes, and commercial building operation.

Residential Energy Consuming Equipment

Under the sponsorship of the Department of Energy, we are developing standard testing and rating procedures for central heat pumps, air conditioners, furnaces, boilers, and water heaters. The procedures are used to estimate the annual energy efficiency and cost of operation of the individual appliance or equipment. DOE establishes the minimum standards based on the predicted performance of the equipment, and all manufacturers advertise and label their equipment with the information. With this information consumers can then make informed choices about which appliance or equipment they wish to purchase. Our current emphasis is on developing testing and rating procedures for new integrated appliances such as space heating boilers which also heat domestic hot water, and central heat pumps that provide domestic hot water through the use of waste heat.

Building Thermal Envelopes

We are developing laboratory test procedures to determine the dynamic properties of full-scale walls so that designers can provide better estimates of wall performance. Field measurement techniques for determining on-site wall thermal losses are being refined, and the field results are being used to develop guidelines for use by designers, engineers and builders in preventing unwanted thermal losses in commercial buildings. We are working to develop experimental techniques to determine the performance of foam insulations blown with ozone-safe refrigerants. We are developing a major new computer simulation program to predict moisture migration within walls. We anticipate that this will lead to design guidelines that can be used for preventing moisture accumulation and the resulting energy losses.

Commercial Building Operation

Under controlled laboratory conditions, we are gathering data on the optimum performance of lighting and air conditioning systems

for commercial buildings. We experimentally evaluated 10 design configurations in our Light/Heating, Ventilating, Air Conditioning facility and developed design guidelines for use by industry to minimize peak cooling loads and to reduce energy use in the commercial office.

We are developing new laboratory procedures to test and rate computerized control systems for buildings. Computer simulations of mechanical systems are connected to the actual control system intended for use in a building, and are used to evaluate the control algorithms without requiring the disclosure of the proprietary software used in the control system. We are developing for GSA procedures for "commissioning" of large building mechanical systems to ensure performance as designed; and criteria for the selection and use of new direct digital controls.

ATMOSPHERIC CHEMISTRY

NIST scientists, working closely with their counterparts in NOAA and NASA, have been leaders in research leading to basic understanding of the mechanisms by which CFCs break down in the atmosphere and catalyze the destruction of the protective ozone layer. We played a key role in the 1989 Airborne Arctic Stratospheric Expedition. This project, based in Stavanger, Norway in January and February of 1989, has produced significant scientific data which will allow us to model the chemistry of stratospheric ozone depletion much more accurately. Last spring, we released, through our Standards Reference Data program, a personal computer version of the chemical kinetics database. This database contains 8000 determinations of rate constants for approximately 2000 chemical reactions of importance for modelling combustion and atmospheric processes. It will facilitate the calculation of atmospheric lifetimes of greenhouse gases and ozone depletion potentials.

ATMOSPHERIC MONITORING

We also have several projects contributing to the monitoring of gases and particles in the atmosphere. The objectives of our efforts are to: (1) accurately measure atmospheric components, (2) provide standards and, (3) identify types and sources of pollution.

Accurate measurements are critical in determining general trends for concentrations of atmospheric gases and particles, and as a bases for developing models to predict the effects of these gases and particles on the atmosphere, and in determining their role in the carbon cycle.

NIST standards are used for the calibration of measurement systems and equipment, and as reference points for the national and international measurement community. We provide approximately 95 Standard Reference Materials for various atmospheric gases, including the major greenhouse gases carbon dioxide (CO_2), nitrogen dioxide (N_2O), methane (CH_4), carbon monoxide (CO), and CFCs. We

also provide SRMs for particles typically found in urban air and diesel exhaust.

During the past several years in cooperation with EPA, we have designed and built 14 instruments (called photometers) to measure ozone. Ten of these instruments are used by EPA for their ozone measuring network throughout the U.S. to ensure accurate and compatible ozone measurements. Two of these photometers reside at NIST. Of the other two, one is in Canada at the Ministry of the Environment and is used to calibrate their ozone measuring instrumentation. The other is in Sweden at their National Environmental Protection Board. The photometer in Sweden, calibrated periodically to NIST instruments, has been designated the primary standard for two major European ozone measuring programs. More than 20 countries calibrate their ozone measuring instruments against the "NIST" instrument in Sweden.

Source identification of pollutants establishes whether the pollutants are derived from man-made or natural sources. We can determine through isotopic measurements whether the pollution comes from fossil fuel (e.g. vehicle emissions) or biogenic sources (e.g., wood burning). This information can be used in the regulatory area as well as for making decisions on taking necessary corrective actions.

Mr. Chairman, I would like bring to your attention, and offer an informational brochure for the record, the 1990 Johnson Conference "Our Changing Atmosphere: Challenges in Measurement Technology" which is sponsored by the American Society for Testing and Materials (ASTM) Committee D-22 on Sampling and Analysis of Atmospheres. The conference will be held July 8-13, 1990 at Johnson State College, Johnson, Vermont. To quote from the brochures introduction: "Today, we are faced with some of the most difficult measurement challenges since Committee D-22 was founded in 1951. These measurements will be critical to meaningful national policies on atmospheric measurement and standards. The Johnson Conference is intended to be a process where experiences are shared, issues raised, and learning accelerated." Participants include government (NIST, NASA, NOAA, State and local government organizations), universities, industry associations, and research organizations.

Thank you, Mr. Chairman. I would be happy to answer any questions you may have.

Senator GORE. We will look forward to that in your prepared remarks, and we will hold questions until the rest of the panel has concluded. Thank you.

Mr. Christopher Flavin with Worldwatch Institute, please proceed.

STATEMENT OF CHRISTOPHER FLAVIN, VICE PRESIDENT FOR RESEARCH, WORLDWATCH INSTITUTE

Mr. FLAVIN. Thanks very much, Mr. Chairman.

I want to start out by in effect re-emphasizing the point that Senator Kerry was making earlier. I think the real significance of both Earth Day and the general awakening that we see on the part of individual citizens and attempt to take action on their own really comes in the broader societal and political impact that this is likely to have.

Certainly the individual actions themselves can make some small differences, but it is really mobilizing people, encouraging them to put pressure, both on corporations and on the government, and generally moving the whole process of societal change forward that is the true significance of the changes that we have seen recently.

When people are personally involved, when they are taking personal responsibility for things, there is a whole new level of credibility and a real push forward that is simply not going to exist if people's actions are limited to writing their Senators and Congressmen or holding petition drives.

I want to focus on two things that I think come out of this question of looking at the broader significance of the new consumer environmental movement that we see. One is to try to come up with a guiding vision of where it is that we are headed, to try to lay out a sense of what these young children who are looking for something to do immediately, what they can look forward to in terms of an environmentally more sustainable society in the future. That is laid out in a lot more detail in my written testimony.

I just want to focus on a few of the fundamentals here. I think the most important and probably overriding concern is that if we are going to achieve a sustainable society in the next several decades, we are going to have to have some basic changes in our value systems and in all of our approaches to the natural world.

I do think that recycling and saving energy and all the other things that people are doing today are part of that. However, I think they are just the beginning, that we need to begin rethinking what it is that we really place our primary values upon.

For example, as was brought up by the previous panel, we have to question whether it is a better electronic device, a more luxurious automobile, or a greener lawn that is going to be the priority? Or are we going to begin gradually to shift to other priorities, looking at basic questions of what it is that we are providing for our children, grandchildren, and future generations?

Are we in fact practicing good stewardship of the natural resources that were bestowed upon us?

I think inevitably over time it is going to occur to people not necessarily that they have to give up basic amenities and change their lifestyles in ways that are going to cause real hardship and pain,

but rather that there are things in terms of de-emphasizing materialism, in terms of not measuring your life by how much you can consume over the several decades that you have on this planet, that do need to be addressed and need to be addressed at a fundamental level.

Again, I think some of the family members that we saw in the previous panel are in effect pioneering in some of that rethinking. They are not all the way there yet. Very few of us have gone all the way, but there is a fundamental transformation that is needed and I think we do have the beginnings of it underway.

In terms of the way our economies and societies are going to look several decades from now, I think there can be no doubt but that we are going to see fundamental changes. For example, in our energy systems, if we are going to play our part as a nation in terms of having a less carbon-intensive energy economy, 30 or 40 years from now we are going to have to have an economy that perhaps relies on fossil fuels for 10 or 20 percent of its total supplies, rather than the 80 to 90 percent that currently is the situation.

To do that we are going to have to have extraordinary levels of efficiency, we are going to have to adopt all of the technologies that were laid out by Chris Calwell and many more besides.

In addition, we are going to have to have a largely renewable energy based generating system, producing both electricity that can be used for homes, industries, commercial buildings, and so on, and also develop hydrogen energy sources, for example, from sunshine that would be used to power our transportation systems.

Many of the technologies needed to accomplish this are in fact already available today and are likely to fall in cost substantially. But I think people need this vision that in fact we can create a non-fossil fuel-based economy, and I think people need to have a positive sense that the small steps that they can take today in terms of purchasing a more efficient car can in fact be leading in that direction.

In terms of our material systems and recycling, 30 or 40 years from now I think it will be a routine matter, that virtually everything will be recycled. Much of that is going to require more than individual actions or even community policies. It is going to require redesign of basic materials to make it easier for them to be recycled.

But that will, I think, become almost an essential part of manufacturing, both in terms of its ability to save materials and in terms of its ability to save on energy as well.

Our agricultural systems are going to have to be fundamentally transformed. They are going to have to be much less energy-intensive, much less chemicals-intensive, and much less water-intensive. Again, the technologies are available. Many of them were recently endorsed by the National Academy of Sciences and I think are ready to move forward.

Transportation is probably one of the most fundamental areas of change we are likely to see in coming decades, to make it possible, for example, for the Deweys to move about in their suburban communities in a way that is not only much less energy-intensive, but that is convenient, that is safe, and that provides a much more environmentally sustainable system. I think it is going to require not

only that we move to efficient cars, to clean, renewable fuels, but over time that we redesign transportation systems, that we emphasize public transportation much more heavily, and that we also begin the redesign of cities so that people do not have to travel about to the extent that they do today and so that they can make many of their needed trips by walking or cycling.

Let me wrap up by re-emphasizing, and I know you, Mr. Chairman, are a real strong proponent of this notion, but there is in fact a continuing critical role for the government to play, and I think that that is fully compatible with individual action. The two really do go hand in hand. And certainly, if Earth Day is to turn out to be a real success, it is going to have to result in much more fundamental changes in our environmental laws than we have seen in the last several months, where in my mind at least most of the environmental legislation that has been moving forward has not been nearly as ambitious as what is required.

But to take, I think, energy as one very important example, we are simply never going to see the really dramatic improvements in efficiency that are needed by people searching out lightbulbs in catalogues and perhaps going to their hardware store if they one day become available there. In order to get those technologies moving forward, we need to overcome the enormous market barriers that inevitably are going to impede most people from laying down 13 dollars or more to purchase a lightbulb.

The programs that we see in a number of areas of the country where utilities are actually investing money and providing them at a low price or free of charge to customers is the kind of thing that needs to happen. It simply does not make sense and we cannot afford to have a situation where utilities are using one discount rate to purchase environmentally damaging power plants and a very different discount rate when they are deciding not to invest in energy efficiency.

So we do need very profound changes in government policy, not only in the Federal level, but I think in many of these areas state and local policies are equally, if not more, important.

But I think, again to take the energy area as an example, despite the new lip service that we have seen on the part of this Administration to energy efficiency and renewable energy, I think that it is fair to say that most of the important Federal policies in these areas still tend to be negative. They still tend to disfavor renewable energy sources. They tend to discourage investment in energy efficiency.

And I do think that it is through the actions of at this point the Congress that we are going to need to see much more fundamental changes in policy if we are going to accelerate the process of change beyond what individual actions alone can ever accomplish.

Thanks.

[The statement follows:]

STATEMENT OF CHRISTOPHER FLAVIN, VICE-PRESIDENT FOR RESEARCH, WORLDWATCH INSTITUTE

Mr. Chairman and members of the Committee, thank you for the opportunity to testify before you this morning. This Committee's attention to the fate of the planet and to the role of individual actions and responsibilities could not fall at a more fitting time. This Sunday, millions of people in over 140 countries celebrated Earth Day 1990, and many of them are now asking what they can do to reverse environmental decline.

Threats such as climate change and ozone depletion underscore the fact that ecological degradation has reached global proportions. Meanwhile, the increasing severity and spread of more localized problems--including soil erosion, deforestation, water scarcity, toxic contamination, and air pollution--are already beginning to slow economic and social progress in much of the world.

Individual values and actions must play a critical role if this dangerous downward spiral is to be reversed. The other witnesses at this hearing will spell out many of these measures. My focus will be on the notion that these actions must be guided by a coherent vision if they are to be an effective force for change. I will attempt to describe such a vision--of the type of world that we need to create if we are to pass to future generations a healthy and productive planet.

A sustainable society is one that satisfies its needs without jeopardizing the prospects of future generations. But in order to meet that requirement, we must start then with some central questions: If not coal and oil to power society, then what? If forests are no longer to be cleared to grow food, then how is a larger population to be fed? If a throwaway culture leads inevitably to pollution and resource depletion, how can we satisfy our material needs? In sum, if the present path is so obviously

unsound, what picture of the future can we use to guide our actions toward a global community that can endure?

Ideas and technologies we can't now foresee will influence society's future course. Yet, just as any technology of flight must abide by basic principles of aerodynamics, so must a lasting society satisfy some elementary criteria. With that understanding and the experience garnered in recent decades, it is possible to create a vision of a society quite different, indeed preferable, to today's.

If humanity achieves sustainability, it will do so within the next 40 years. If we have not succeeded by then, environmental deterioration and economic decline will be feeding on each other, leading to social decay and political upheaval. At such a point, reclaiming any hope of a sustainable future might be impossible. Our vision therefore looks to the year 2030, a time closer to the present than is World War II.

Whether Earth Day 2030 turns out to be a day to celebrate lasting achievements or to lament missed opportunities is largely up to each one of us as individuals. For in the end, it is individual values that drive social change. Progress toward sustainability thus hinges on a collective deepening of our sense of responsibility to the earth and to our offspring. Without a reevaluation of our personal aspirations and motivations, we will never achieve an environmentally sound global community.

Begin with the Basics

In attempting to sketch the outlines of a sustainable society, we need to make some basic assumptions. First, our vision of the future assumes only existing technologies and foreseeable improvements in them. This clearly is

a conservative assumption: 40 years ago, for example, some renewable energy technologies on which we base our model didn't even exist.

Second, the world economy of 2030 will not be powered by coal, oil and natural gas. It is now well accepted that continuing heavy reliance on fossil fuels will cause catastrophic changes in climate. The most recent scientific evidence suggests that stabilizing the climate depends on eventually cutting annual global carbon emissions to some two billion tons per year, about one-third the current level. Taking population growth into account, the world in 2030 will therefore have per-capita carbon emissions about one-eighth the level found in Western Europe today.

The choice then becomes whether to make solar or nuclear power the centerpiece of energy systems. We believe nuclear power will be rejected because of its long list of economic, social, and environmental liabilities. The nuclear industry has been in decline for over a decade. Only 90 plants remain under construction, and most will be completed in the next few years. Safety concerns and the failure to develop permanent storage for nuclear waste have disenchanted many citizens.

It is possible scientists could develop new nuclear technologies that are more economical and less accident-prone. Yet, this would not solve the waste dilemma. Nor would it prevent the use of nuclear energy as a stepping stone to developing nuclear weapons. Trying to stop this in a plutonium-based economy with thousands of operating plants would require a degree of control incompatible with democratic political systems. Societies are likely to opt instead for diverse, solar-based systems.

The third major assumption is about population size. Current United Nations projections have the world headed for nearly nine billion people by

2030. This figure implies a doubling or tripling of the populations of Ethiopia, India, Nigeria, and scores of other countries where human numbers are already overtaxing natural support systems. But such growth is inconceivable. Either these societies will move quickly to encourage smaller families and bring birthrates down, or rising death rates from hunger and malnutrition will check population growth.

The humane path to sustainability by the year 2030 therefore requires a dramatic drop in birthrates. As of 1990, 13 European countries had stable or declining populations; by 2030, most countries are likely to be in that category. We assume a population 40 years from now of at most eight billion that will either be essentially stable or declining slowly toward a number the earth can comfortably support.

Dawn of a Solar Age

In many ways, the solar age today is where the coal age was when the steam engine was invented in the 18th century. At that time, coal was used to heat homes and smelt iron ore, but the notion of using coal-fired steam engines to power factories or transportation systems was just emerging. Only a short time later the first railroad started running, and fossil fuels began to transform the world economy.

Many technologies have been developed that allow us to harness the renewable energy of the sun effectively, but so far these devices are only in limited use. By 2030 they will be widespread and much improved. The pool of energy these technologies can tap is immense: The annual influx of accessible renewable resources in the United States is estimated at 250 times the country's current energy needs.

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By 2030, solar panels will heat most residential water around the world. A typical urban landscape may have thousands of collectors sprouting from rooftops, much as television antennas do today. Electricity will come via transmission lines from solar thermal plants located in desert regions of the United States, North Africa and central Asia. An 80-megawatt solar thermal plant built in the desert east of Los Angeles in 1989 converted an extraordinary 22 percent of incoming sunlight into electricity--at a third less than the cost of power from new nuclear plants.

Power will also come from photovoltaic solar cells, a semiconductor technology that converts sunlight directly into electricity. Currently, photovoltaic systems are less efficient than and four times as expensive as solar thermal power, but by 2030 their cost will be competitive. Photovoltaics will be a highly decentralized energy source found atop residential homes as well as adjacent to farms and factories.

Using this technology, homeowners throughout the world may become producers as well as consumers of electricity. Indeed, photovoltaic shingles have already been developed that turn roofing material into a power source. As costs continue to decline, many homes are apt to get their electricity from photovoltaics; in sunny regions residents will sell any surplus to the utility company.

Wind power, an indirect form of solar energy generated by the sun's differential heating of the atmosphere, is already close to being cost competitive with new coal-fired power plants. Engineers are confident they can soon unveil improved wind turbines that are economical not just in California's blustery mountain passes, where they are now commonplace, but in vast stretches of the U.S. northern plains and many other areas. Forty

years from now the United States could be deriving 10 to 20 percent of its electricity from the wind.

Small-scale hydro projects are likely to be a significant source of electricity, particularly in the Third World, where the undeveloped potential is greatest. As of this year hydropower supplied nearly one-fifth of the world's electricity. By 2030 that share should be much higher, although the massive dams favored by governments and international lending agencies in the late-20th century will be a declining proportion of the total hydro capacity.

Living plants provide another means of capturing solar energy. Through photosynthesis, they convert sunlight into biomass that can be burned or converted to liquid fuels such as ethanol. Today, wood provides 12 percent of the world's energy, chiefly in the form of firewood and charcoal in developing countries. Its use will surely expand during the next 40 years, although resource constraints will not permit it to replace all of the vast quantities of petroleum in use today.

Geothermal energy taps the huge reservoir of heat that lies beneath the earth's surface, making it the only renewable source that does not rely on sunlight. Continuing advances will allow engineers to use previously unexploitable, lower-temperature reservoirs that are hundreds of times as abundant as those in use today. Virtually all Pacific Rim countries, as well as those along East Africa's Great Rift and Mediterranean Sea will draw on geothermal resources.

Nations in what now is called the Third World face the immense challenge of continuing to develop their economies without massive use of fossil fuels. One option is to rely on biomass energy in current quantities

but to step up replanting efforts and to burn the biomass much more efficiently, using gasifiers and other devices. Another is to turn directly to the sun, which the Third World has in abundance. Solar ovens for cooking, solar collectors for hot water, and photovoltaics for electricity could satisfy most energy needs.

In both industrial and developing nations, energy production inevitably will be much more decentralized, breaking up the utilities and huge natural gas, coal and oil industries that have been a dominant part of the economic scene in the late-20th century. Indeed, a world energy system based on the highly efficient use of renewable resources will be less vulnerable to disruption and more conducive to market economics.

Efficient in All Senses

Getting total global carbon emissions down to two billion tons a year will require vast improvements in energy efficiency. Fortunately, many of the technologies to accomplish this feat already exist and are cost-effective. No technical breakthroughs are needed to double automobile fuel economy, triple the efficiency of lighting systems, or cut typical home heating requirements by 75 percent.

Automobiles in 2030 are apt to get at least 100 miles per gallon of fuel, four times the current average for new cars. The outlines of such vehicles may be like is seen in the Volvo LCP 2000, a recently developed prototype automobile. It is an aerodynamic four-passenger car that weighs half as much as today's models and has a clean-burning diesel engine. With the addition of a continuously variable transmission and a flywheel energy storage device, this vehicle will get 90 miles to the gallon.

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Forty years from now, Thomas Edison's revolutionary incandescent light bulbs may be found only in museums--replaced by an array of new lighting systems, including halogen and sodium lights. The most important new light source may be compact fluorescent bulbs that use 18 watts rather than 75 to produce the same amount of light.

In 2030, homes are likely to be weather-tight and highly insulated, greatly reducing the need for heating and cooling. Some superinsulated homes in the Canadian province of Saskatchewan are already so tightly built that it doesn't pay to install a furnace. Homes of this kind use one-third as much energy as do modern Swedish homes, or one-tenth the U.S. average.

By the year 2030, a much more diverse set of transportation options will exist. The typical European or Japanese city today has already taken one step toward this future. Highly developed rail and bus systems move people efficiently between home and work: In Tokyo only 15 percent of commuters drive cars to the office. The cities of 2030 are apt to be criss-crossed by inexpensive, street-level light rail systems that allow people to move quickly between neighborhoods.

Automobiles will undoubtedly still be in use four decades from now, but their numbers will be fewer and their role smaller. Within cities, only electric or clean hydrogen-powered vehicles are likely to be permitted. Most of these will be highly efficient "city cars." The energy to run them may well come from solar power plants.

The bicycle will also play a major role in getting people about, as it already does in much of Asia as well as in some industrial-country towns and cities. In Amsterdam and Davis, California, bike-path networks have encouraged widespread pedaling. There are already twice as many bikes as

cars worldwide. In the bicycle-centered transport system of 2030, the ratio could easily be 10 to 1.

Forty years from now, people will live closer to their jobs, and much socializing and shopping will be done by bike rather than in a one-ton automobile. Computerized delivery services may allow people to shop from home--consuming less time as well as less energy. In addition, a world that allows only two billion tons of carbon emissions cannot be trucking vast quantities of food and other items thousands of miles, requiring that agriculture be more decentralized.

The automobile-based modern world is now only about 40 years old, but with its air pollution and traffic congestion it hardly represents the pinnacle of social evolution. Although a world where cars play a minor role may be hard to imagine, our grandparents would have had just as hard a time visualizing today's world of traffic jams and smog-filled cities.

Nothing to Waste

In the sustainable, efficient economy of 2030, waste reduction and recycling industries will have largely replaced the garbage collection and disposal companies of today. The throwaway society that emerged during the late-20th century uses so much energy, emits so much carbon, and generates so much air pollution, acid rain, water pollution, toxic waste, and rubbish that it is strangling itself. Rooted as it is in planned obsolescence and appeals to convenience, it will be seen by historians as an aberration.

A hierarchy of options will guide materials policy in the year 2030. The first priority, of course, will be to avoid using any nonessential item. Second will be to reuse a product directly--for example, refilling a glass

beverage container. The third, will be to recycle the material to form a new product. Fourth, the material can be burned to extract whatever energy it contains, as long as this can be done safely. The option of last resort will be disposal in a landfill.

In the sustainable economy of 2030, the principal source of materials for industry will be recycled goods. Industries will turn to virgin raw materials only to replace any losses in use and recycling.

The effect on air and water quality will be obvious. For example, steel produced from scrap reduces air pollution by 85 percent, cuts water pollution by 76 percent, and eliminates mining wastes altogether. Making paper from recycled material reduces pollutants entering the air by 74 percent and the water by 35 percent. It also reduces pressures on forests in direct proportion to the amount recycled.

The economic reasons for such careful husbanding of materials will by 2030 seem quite obvious. Just 5 percent as much energy is needed to recycle aluminum as to produce it from bauxite ore. For steel produced entirely from scrap, the saving amounts to roughly two-thirds. Newsprint from recycled paper takes 25 to 60 percent less energy to make than that from wood pulp. And recycling glass saves up to a third of the energy embodied in the original product.

Societies in 2030 may also have decided to replace multi-sized and shaped beverage containers with a set of standardized ones made of durable glass that can be reused many times. These could be used for fruit juices, beer, milk and soda pop.

One of the cornerstones of a sustainable society will likely be its elimination of waste flows at the source. Industry will have restructured

manufacturing processes to slash wastes by a third or more from 1990 levels. Food packaging, which in 1986 cost American consumers more than American farmers earned selling their crops, will have been streamlined. Food items buried in three or four layers of packaging will be a distant memory.

As recycling reaches its full potential over the next 40 years, households will begin to compost yard wastes rather than put them out for curbside pickup. Garbage flows will be reduced by one-fifth or more and gardeners will have a rich source of humus.

In addition to recycling and reusing metal, glass and paper, a sustainable society must also recycle nutrients. In nature, one organism's waste is another's sustenance. In cities, however, human sewage has become a troublesome source of water pollution. Properly treated to prevent the spread of disease and to remove contaminants, sewage will be systematically returned to the land in vegetable-growing greenbelts around cities, much as is done in Shanghai and other Asian cities today. Other cities will probably find it more efficient to follow Calcutta's example and use treated human sewage to fertilize aquacultural operations.

How to Feed Eight Billion

Imagine trying to meet the food, fuel, and timber needs of eight billion people--nearly three billion more than the current population--with 960 billion fewer tons of topsoil (more than twice the amount on all U.S. cropland) and one billion fewer acres of trees (an area more than half the size of the continental United States).

That, in a nutshell, will be the predicament faced by society in 2030 if current rates of soil erosion and deforestation continue unaltered for

the next 40 years. It is a fate that can only be avoided through major changes in land use.

Of necessity, societies in 2030 will be using the land intensively; the needs of a population more than half again as large as today's cannot be met otherwise. But, unlike the present, tomorrow's land-use patterns would be abiding by basic principles of biological stability: nutrient retention, carbon balance, soil protection, water conservation, and preservation of species diversity. Harvests will rarely exceed sustainable yields.

Meeting food needs will pose monumental challenges. By 2030, assuming cropland area expands by 5 percent between now and then and that population grows to eight billion, cropland per person will have dropped to a third less than we have in today's inadequately fed world. Virtually all of Asia, and especially China, will be struggling to feed its people from a far more meager base of per-capita cropland area.

In light of these constraints, the rural landscapes of 2030 are likely to exhibit greater diversity than they do now. Variations in soils, slope, climate, and water availability will require different patterns and strains of crops grown in different ways so as to maximize sustainable output. For example, farmers may adopt numerous forms of agroforestry--the combined production of crops and trees--to provide food, biomass, and fodder, while also adding nutrients to soils and controlling water runoff.

Efforts to arrest desertification, now claiming 15 million acres each year, may by 2030 have transformed the gullied highlands of Ethiopia and other degraded areas into productive terrain. Much sloping land rapidly losing topsoil will be terraced, protected by shrubs or nitrogen-fixing trees planted along the contour.

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Halting desertification also depends on eliminating overgrazing. The global livestock herd in 2030 is likely to be much smaller than today's three billion. It seems inevitable that adequately nourishing a world population 60 percent larger than today's will preclude feeding a third of the global grain harvest to livestock and poultry, as is currently the case. As meat becomes more expensive, the diets of the affluent will move down the food chain to greater consumption of grains and vegetables, which will also prolong lifespans.

A Healthy Respect for Forests

Forests and woodlands will be valued more highly and for many more reasons in 2030 than is the case today. The planet's mantle of trees, already a third smaller than in pre-agricultural times and shrinking by more than 27 million acres per year now, will be stable or expanding as a result of serious efforts to slow deforestation and to replant vast areas.

Long before 2030, the clearing of most tropical forests will have ceased. Since most of the nutrients in these ecosystems are held in the leaves and biomass of the vegetation rather than in the soil, only activities that preserve the forest canopy are sustainable. A large portion of tropical forests still standing in 2030 will be exploited in a variety of benign ways by people living in and around them. Hundreds of "extractive reserves" will exist, areas in which local people harvest rubber, resins, nuts, fruits, medicines, and other forest products. While it is impossible to say how much virgin tropical forest would remain in 2030 if sustainability is achieved, certainly the rate of deforestation will have had to slow dramatically by the end of this decade.

Efforts to alleviate the fuelwood crisis in developing countries, to reduce flooding and landslides in hilly regions, and to slow the buildup of carbon dioxide may spur the planting of an additional 500 million acres or so of trees. Many of these plantings will be on private farms as part of agroforestry systems. But plantations may also have an expanded role. Cities and villages will turn to managed woodlands on their outskirts to contribute fuel for heating, cooking and electricity.

Restoring and stabilizing the biological resource base by 2030 depends on a pattern of land ownership and use far more equitable than today's. Much of the degradation now occurring stems from the heavily skewed distribution of land that, along with population growth, pushes poor people into ever more marginal environments. Stewardship requires that people have plots large enough to sustain their families without abusing the land, access to means of using the land productively, and the right to pass it on to their children.

A New Set of Values

The fundamental changes that are needed in energy, forestry, agriculture, and other physical systems cannot occur without corresponding shifts in social, economic, and moral character. During the transition to sustainability, political leaders and citizens alike will be forced to reevaluate their goals and aspirations and to adjust to a new set of principles that have at their core the welfare of future generations.

Shifts in employment will be among the most visible as the transition gets under way. Moving from fossil fuels to a diverse set of renewable energy sources, extracting fewer materials from the earth and recycling

more, and revamping farming and forestry practices will greatly expand opportunities in new areas.

As the transition to a more environmentally sensitive economy progresses, sustainability will gradually eclipse growth as the focus of economic policymaking. As a yardstick of progress, the gross national product (GNP) will be seen as a bankrupt indicator. By measuring flows of goods and services, GNP undervalues qualities a sustainable society strives for, such as durability and resource protection, and overvalues planned obsolescence and waste. The pollution caused by a coal-burning power plant, for instance, raises GNP by requiring expenditures on lung disease treatment and the purchase of a scrubber to control emissions. Yet society would be far better off if power were generated in ways that did not pollute the air in the first place.

National military budgets in a sustainable world will be a small fraction of what they are today. Sustainability cannot be achieved without a massive shift of resources from military endeavors into other development activities. Rather than maintaining large defense establishments, governments may come to rely on a strengthened U.N peacekeeping force.

Movement toward a lasting society cannot occur without a transformation of individual actions, priorities and values, a transformation that effectively began with the celebration of Earth Day 1990. While it is helpful for people to recycle their newspapers or conserve energy, such actions alone are not enough. Rather, they must be part of a broader shift in values and a corresponding transition in political priorities.

Throughout the ages, philosophers and religious leaders have denounced materialism as a path to human fulfillment. Yet societies across the

ideological spectrum have persisted in equating quality of life with increased consumption.

Because of the strain on resources it creates, materialism simply cannot survive the transition to a sustainable world. As public understanding of the need to adopt simpler and less consumptive lifestyles spreads, it will become unfashionable to own fancy new cars, clothes and the latest electronic devices. The potential benefits of unleashing the human energy now devoted to producing, advertising, buying, consuming, and discarding material goods are enormous.

As the amassing of personal and national wealth becomes less of a goal, the gap between haves and have-nots will gradually close, eliminating many societal tensions. Ideological differences may fade as well, as nations adopt sustainability as common cause, and as they come to recognize that achieving it requires a shared set of values that includes democratic principles, freedom to innovate, respect for human rights, and acceptance of diversity. With the cooperative tasks involved in repairing the earth so many and so large, the idea of waging war could become an anachronism.

Individual actions and political change go hand-in-hand. Individuals who take personal responsibility for a sustainable lifestyle are far more likely to insist that corporations not pollute the environment and that political leaders enact effective environmental policies. People who can demonstrate to others that they have made personal lifestyle changes are in a far stronger position to insist on society wide changes.

The task of building a sustainable society is an enormous one that will take decades rather than years. Indeed, it is an undertaking that will easily absorb the energies that during the past 40 years have been devoted to the Cold War. The reward in the year 2030 could be an Earth Day with something to celebrate: the achievement of a society in balance with the resources that support it, one that no longer destroys the underpinnings of its future.

Senator GORE. Excellent. Thank you very much.

Our final witness on this panel is Dr. John Andelin. Welcome.

STATEMENT OF DR. JOHN ANDELIN, ASSISTANT DIRECTOR, SCIENCE, INFORMATION, AND NATURAL RESOURCES DIVISION, OFFICE OF TECHNOLOGY ASSESSMENT; ACCOMPANIED BY DR. ROSINA BIERBAUM; AND DR. HOWARD LEVENSON, SENIOR ANALYSTS

Dr. ANDELIN. Thank you, Mr. Chairman.

I have to say that what I learned from you about governance and the political process totally overshadows any science that I shared with you. But I appreciated the nice remarks.

I should also say that it has been fun and challenging working with you since you first came to Congress, and it does remain so.

Senator GORE. I am not sure how to take that.

Dr. ANDELIN. It is a compliment.

Senator GORE. Thank you very much.

Dr. ANDELIN. Let me set a little context for the environment. It comes in all sizes, from homes, cities, regions, nation, the globe. It comes in all time scales, from now, years, decades, generations, perhaps centuries. And it comes in different concerns or labels or flavors or whatever—air, water, land; urban; rural, health of individuals, species, areas; and so on.

The system that encompasses all of that is immense, is awesomely complex, and it is all connected. The changes that we have seen due to human activities have been driven by population and economic growth. Those forces look to us to be relatively unabated, and if one looks at developing countries even more so than here.

We would conclude that the maintenance and repair of our environment is a life-long job.

In terms of individual action, the answer is yes, it is wonderful. It helps immediately. It will save energy absolutely or reduce the growth that would have been. It will reduce the volume and the toxicity of municipal waste.

If done with enough conviction, it will begin to affect manufacturers decisions as to the kinds of products and the content and the makeup of the products. So it helps.

It sets a tone for others. It is a wonderful example to set for children, the children then for their colleagues and so on. So it perpetuates an ethic or a style that is very important.

It changes (or enforces) an individual's own attitude towards themselves and gives them a sense that they can indeed affect their own life and perhaps a larger piece of society by taking individual action and seeing that it can matter. It shows individuals that they have some power, that they are capable of doing more.

And, finally, I would expect that it encourages them to put pressure on larger institutions, such as their communities and the Federal government.

So individual action is a key starting place.

It has limitations, though. One times a small effort is a small number. If you add all these small efforts, they will be no larger (if they are taken singly and independently) than the sum of that number of small efforts. In fact, they would probably be somewhat

smaller than that because some people will be pursuing one of the time horizons or one of the regional scales or one of the kinds of environmental concern and others will be pursuing others, and now and then there is some conflict between what one would pursue for one goal and what one would pursue for another.

An example that I have heard used recently is as follows: if you are worried about acid rain, then clean coal is a good idea; if you are worried about global warming, it is not so clear it is a good idea. At the level of individual action, that same kind of thing could happen.

What books such as "50 Ways" and its friends do is to help individuals who, as one quoted to me recently, are really fed up with mixed signals, and they start to set the record a little clearer. They provide information that may indeed have been available or known for years or even a decade or two in some cases, but they put it in the hands of the booksellers at the airports. These books put it in the hands of people in a publicly accessible way, which is very different from most government reports or even many of the environmental movement and public interest movement reports. The information is really there where people can see.

Also, by being consistent, these books eliminate some of the cancellation effects of different actions. They are important contributions.

Individual action is clearly necessary, but it is not sufficient. More needs to be done. Fortunately, more can be done by those same individuals acting in concert. Through public interest groups and through what one would call government, either loosely, neighborhoods, or more formally, up to the Federal government, and perhaps international associations.

Let me take just a moment or two to address a few things that the government can do that will assist individuals, both in the actions they are taking and in reaching the goals that we would like to reach.

Government can regulate and set standards. We have seen that with CAFE, with various kinds of labeling. (NIST in fact helps in setting those standards.) The Montreal Protocol, too, is an example of a regulation. At local levels there is zoning, and there are all kinds of transportation demand controls.

These are tricky. They require care.

Government can do various kinds of research, development, demonstration. The low-E window and the compact fluorescent bulb we saw earlier are examples of results of R&D. Our earliest work together was thinking about the kinds of research and development that, we then said, if done right in the seventies and eighties, gives us a base for energy policy in the nineties and beyond.

I think some of the yo-yo funding has cut off some of the effectiveness of that.

Senator GORE. Of course we lost the eighties. We did well in the latter part of the seventies.

Dr. ANDELIN. It has not been a very steady effort.

Senator GORE. And then the Reagan Administration said, we do not need any of this stuff, and just eliminated it. And now we are having to go back and try to undo some of the damage they did.

Dr. ANDELIN. The interruption certainly set things back a long way.

I would comment on the research, development, and demonstration aspect that, if we are really going to look at transportation management and understand how cities are to work and if we are going to understand and try to solve global warming, which involves international cooperation on scales we have never seen before, then RD&D has to include what are called the softer disciplines, political and social science and so on. We need to understand negotiation and the decisions that people make.

Government can provide various financial incentives or disincentives or subsidies. Taxes, for example. I would comment that subsidies and taxes can be coupled in many cases (the term is "revenue neutral," I suppose). One can tilt what it is one wishes without dramatically affecting the total macroeconomic system. That is something we need to take into account if the Federal government does get more involved in either taxation or subsidies for environmental reasons.

Senator GORE. May I interject at that point. I have introduced a proposal that I call the Environmental Security Trust Fund, which would impose taxes on the basis of pollution and set up individual accounts in an Environmental Security Trust Fund, which people could draw upon in order to subsidize the purchase of more environmentally benign substitute technologies.

Certain definitional problems, of course, but the basic idea builds upon the statement you just made.

Dr. ANDELIN. That is precisely the principle.

One of the other, very direct ways of financial support the Federal government can utilize is procurement, of course, and that was discussed in an earlier panel and we can pick it up more here if you'd like.

Information distribution is important. When I am confronted with a book as successful as the one we heard about this morning, it may be that the feds should give the information to the authors and not to the public at large.

The Federal government can set an example. There are lots of ways of doing that. Procurement is one; the way we operate is another.

One of the bills of the seventies that was intended to have the Federal Government set an example had to do with being "life cycle cost-effective" with energy use in Federal buildings. (It was part of the National Energy Act.) By the time the act got through, the Federal buildings part was pretty well cut up, and I am not sure it would have had much effect had the law been followed.

But what was intriguing about that was the opposition during its legislative process—OMB was claiming that we could not afford to be life cycle cost-effective with energy use! And at the same time there were lots of smirks, there were a lot of folks that voted against that bill because "we could not afford it".

My last comment about the federal role and governance is that of leadership. I mentioned earlier that we need amazing societal consensus up to the international scale to solve our environmental problems, and that clearly is going to take leadership, not just individual action.

I would have to list some elements of that leadership as: prevention is always easier and cheaper than cleanup afterwards; and fossil energy use becomes a major player in many of the environmental problems we need to face, the most difficult of which may be the global warming issue.

Leadership can remind us continually of the complexity of the issue; can help us to keep the solutions as integrated as possible; and can encourage us to take the next step, to keep moving we must be careful not to get complacent just because we are, as individuals, doing a number of things that are suppose to help.

Maintaining and improving the environment is a lifetime job. The issues are very large and we need to keep looking to the ultimate goal, not be proud of the individual steps.

Finally, leadership can help set goals and build that consensus. That is the basic changes in the value system that Chris just referred to. That is a key role you can help us with.

Thank you.

[The statement follows:]

STATEMENT OF DR. JOHN ANDELIN, ASSISTANT DIRECTOR, SCIENCE, INFORMATION, AND NATURAL RESOURCES DIVISION, OFFICE OF TECHNOLOGY ASSESSMENT

As individuals, in the normal course of our life, we affect our own environment and that of others--whether it be the clearing of land for agricultural use (as our ancestors did generations ago and as developing countries in the tropics are doing today)--or the agricultural practices themselves; whether it be the use of forest, fossil, or nuclear fuel--or the taming of rivers for hydropower; whether it be the mining, manufacture and distribution of the materials of commerce and daily life--or the way we treat the wasted, worn, and obsolete products at the end; and finally, by the size of our families.

By all of these interactions between ourselves and our environment, we're changing what would have been, were we not here. Some of the effects of human interference can surely be considered beneficial to "the environment," but, unfortunately, most are not--air and water pollution; accelerated species extinction; loss of topsoil; desertification; and atmospheric change on local, regional and global scales.

When people were few and far between, their effects were commensurately small--and visited mostly on themselves. As our numbers have grown, so have the size and scope of the undesirable environmental effects of our very being.

Mitigation strategies of various kinds have been implemented by all industrialized countries and many developing ones, but population and economic growth continue their pressure--and point to a somber environmental future for all of us unless we, individually and collectively, act wisely and, I suspect, aggressively.

We need leadership at all levels--local, national and international--to inspire us, to give us a sense of sharing and community, and to help us make some hard decisions; we need ever better information--about the state of the environment, how its myriad of parts interact, and what we can do to minimize our adverse impacts upon it; and, starting with each of us, we need to know how to act as responsible individuals and then to carry out those actions. It is that last category--what individuals can do in their daily activities to combat environmental degradation--that you've asked us to address today. It is a key question, both today and for the 21st century.

Clearly, individuals acting alone cannot solve global problems such as tropical deforestation and climate change. Those are not the boundaries within which we commonly operate. On a local and personal scale, however, individuals can make changes in the way they use energy and materials, and, by the sum of these actions, improve the environment. And the ethic that drives such individual actions, if expressed politically, can make a difference in spurring national policies and international action to reach beyond local boundaries. Both as individuals and as a nation, we can choose to move in a new direction, towards better materials and energy use; and towards more harmonious interactions with the environment...in short, toward a higher quality of life for ourselves and especially for future generations.

Many of the individual actions that help the environment have been known for 15, perhaps 20 or 25 years, but, somehow, they've only slowly reached the consciousness of the public at large. Starting in 1970 with the first Earth Day, citizens have grouped together to do something nationally about the environment. Public concern has waxed and waned, but now--punctuated with the discovery in the mid-1980's of the ozone hole over the Antarctic, amplified by the particularly hot, dry summer of 1988 and the press attention given to the prospect of global warming, and focused by Earth Day 1990--people are more ready to translate concern into individual and political action.

"Fifty Simple Things You Can Do To Save The Earth" and other guides that have appeared as Earth Day approached are succeeding in publicizing relatively easy, common-sense opportunities for individuals in the U.S. and other industrialized nations. These opportunities involve technical changes (what we buy and use) and operational or life-style changes (how to get the most out of what we own and use). Most will result in reducing the amount of energy that we use in our daily lives and reducing both the amount and toxicity of trash that we generate. For example, using fluorescent light

bulbs, fuel-efficient autos (or, even better, mass transit), adding insulation to old homes, and recycling glass, metal, plastic and newspapers, and composting yard wastes can all contribute to solving one or another environmental problem.

A word of caution--and a reminder that government and industry have key continuing roles to play even though individuals need to take the lead in action and in lending political support. Regulations, economic incentives, and other institutional backup will be needed; so, too, will research support. Take recycling, for example. For many people, recycling means separating your newspapers, cans, bottles, etc., and putting them out at the curbside for collection or taking them to a dropoff center. That's only part of it. Recycling is actually a long chain of complicated processes--separation and collection, intermediate processing (e.g., baling cans or paper), delivery to manufacturers, and final manufacturing into a product that is then marketed. OTA has recently concluded that there is room for much more recycling in the United States, but exactly how much more will depend on three critical factors--the availability of high-quality recyclable material (directly related to individual actions), the availability of sufficient processing capacity (industry's responsibility), and sufficient demand for the final recycled products (individual decisions, private market decisions, government regulations and incentives). As the recent glut of recyclable newspapers indicates, these concerns are real and it can be very difficult to accommodate rapid change.

So how can governments help identify environmentally-sound products and practices and make it easier for individuals to make the right choices about them? Our testimony today addresses this question. In particular, I would like to address some of our current problems in managing municipal waste and then move to some aspects of energy use. In both cases I point out some government barriers and incentives related to individual's being able to act in environmentally sound ways.

Municipal Waste

One type of municipal waste that most people hardly think about is the liquids that we pour down household drains--household cleansers and disinfectants, detergents, and polishes, for example, all of which contain organic solvents and other chemicals. For the most part, this is legal. These drain into sewage treatment plants that later empty into rivers and lakes. In addition, used oil from do-it-yourselfers and herbicides and pesticides from gardens end up in storm drains that discharge directly into the same water bodies. Although hazardous wastes legally discharged by industries into sewers are a greater problem, liquid wastes from households also add up to a big problem. These wastes can harm the "microscopic organisms" that do the real work at treatment plants. Generally, these wastes either pass through the plant unaffected by the treatment, cling to particles that make up sewage sludge (and thus make sludge toxic), or are emitted as gases to pollute the atmosphere.

Changing this means changing part of our lifestyles. We can try to purchase cleansers that don't contain chemicals of concern. We also can use less, for example by living with lawns that are less doused with fertilizer and insecticides and thus aren't picture-perfect. When we do have hazardous materials such as pesticides to dispose of, we can take them to household hazardous waste "cleanup" days, which usually are run by companies that specialize in treating such products. Although such programs may be expensive and their significance in terms of risk reduction is not known, they are useful tools for educating the public and manufacturers.

Municipal solid waste (MSW), or trash, is an even bigger story. Everybody can relate to MSW, because it is generated just about everywhere in our society--homes, offices, schools, churches, hospitals, hotels, retail stores, etc. It thus touches virtually every thread of our social fabric. While trash is not the world's greatest health hazard, nor is managing it the greatest technological puzzle, it does provide an excellent example for how industrialized societies treat natural resources.

There are important technical approaches for managing MSW once it is produced--tighter and better monitored and managed landfills, cleaner incinerators, etc.--but the best of these still has drawbacks. The fundamental question then is how far we can reduce the amount and toxicity of the MSW that we generate in the first place and how much of what we do generate can be recycled and put back to useful purpose. From a broad perspective, this means considering the entire MSW "system." By this I mean taking the whole stream into account, from the extraction of virgin materials (e.g., from mines and forests) to secondary materials (e.g., from MSW), from product design and manufacturing, distribution and merchandising, to actual purchase and use.

Growing demands by consumers for products that are "environmentally friendly" actually highlight the links between these components of the system, the mounds of waste that are discarded daily, and other environmental problems (including energy use). Several questions about such products, though, are just beginning to be explored in the United States.

First, it is more difficult than it appears to develop procedures and criteria for environmentally assessing most products. To begin with, there are many relevant criteria--recyclability, energy-efficiency, toxicity, and durability of the products themselves, for example. It gets more complicated when all environmental "lifecycle" costs from developing and using a product are considered (and there is a general consensus that this should be done when possible). These costs include the energy used and pollution generated during extraction of materials, manufacturing, transportation, use, and disposal and management. However, no standardized methodology for doing so has been developed. It is difficult to compare, for example, fossil fuel use and hazardous waste generation in the plastics lifecycle with the soil erosion and dioxins in effluents in the paper lifecycle. And government, industry (both

manufacturers and designers), consumers of all types, and environmental groups do not necessarily weight these criteria similarly. Both technical and political consensus are needed.

Second, credible information about products has to be readily available and easy to interpret if consumers are to make informed purchasing decisions. Labeling is a frequently discussed mechanism for providing consumers this information. Labels already are used to convey key information or ideas and influence purchase decisions (e.g., "no cholesterol" and "no caffeine" labels). To be most accurate, labels should be based on the evaluations of "environmentally friendly" products that I just discussed. Whether programs are voluntary or mandatory, decisions have to be made about the scope of criteria to be included in assessing product lifecycles, how to account for various social and economic costs, what categories of products to target, what information or logos to include, how to evaluate manufacturers' claims, and how to enforce labeling regulations and measure success.

Again, as an example of the questions to be addressed before individual action will be broadly successful, the problem of ensuring information credibility is worth discussing briefly. Currently it is difficult for consumers to gauge claims made by manufacturers and advertisers about products, because there is no independent organization or standardized procedure for evaluating claims. For example, degradable plastic products have been promoted heavily in the marketplace during the last two years, yet several questions about these claims have been raised by OTA and others. Whether or not the questions are answered satisfactorily in the future, the main point is that the average consumer either has no idea that the questions even exist or cannot judge the validity of the claims and counterclaims. Similarly, recycling logos are appearing on all types of products, but in most cases the logo simply means that recycling is technically possible, not that collection systems and processing capacity for recycling are available.

Some labeling systems established in other countries do attempt to address these problems. West Germany has had a labelling program (the "Blue Angel") for over a decade, Canada just started a similar program ("Environmental Choice"), and other countries such as Japan, Australia and Norway are considering programs. In the United States, a non-profit public interest group recently announced that it will begin a product logo program this year. The EPA is examining labeling and awards proposals as part of its own initiatives on MSW reduction, and proposed legislation in the Congress also includes some provisions regarding labeling programs.

Companies that can develop "better" technologies and products are likely to be more competitive, here and abroad. International conventions and trade agreements will continue to give more weight to environmental concerns, and the integration of the European Community and the United Nations Conference on Environment and Development, both scheduled for 1992, will amplify these trends.

Global Issues

From a broader perspective, individual efforts to change the way we design and consume products not only can help solve trash problems but also can provide some lessons for dealing with even larger issues, such as global climate change. These larger issues seem overwhelming at times. Many of the same types of decisions will be needed if we are to achieve a balance between consumption and development in industrialized countries and to help developing countries continue to increase their living standards without doing irreparable damage to the environment. (Currently, the industrialized nations consume the bulk of the world's energy resources and materials and, in the process, generate the majority of greenhouse gas emissions. But with continued growth in population and economy, emissions from the developing nations will equal the industrial world in a few decades.)

Just as MSW touches virtually every thread of our social fabric, so too does energy. For example, electricity is a major part of our lives. It is particularly clean at point of use, but most U.S. electricity comes from burning fossil fuels (particularly coal), which results in both airborne and solid wastes. Likewise, direct combustion of fossil fuels (for home heating or automobile use) results mostly in gases, conveniently vented away from the user, so, again, we don't see a direct link with the eventual environmental damage they may cause.

But such damage does occur. Taken together, use of fossil fuels and the products of their combustion are principal causes of, for example, acid rain, urban ozone and the carbon dioxide buildup associated with the prospect of global climate change. (Extraction of fossil fuels leads to methane emissions and coal strip mining wastelands; delivery has led to catastrophic marine oil spills.)

Since other energy sources--hydro, nuclear, biomass, and even solar--also have their own environmental consequences, responsible use of energy must be a major part of any effort to protect the environment. Individuals, with no new technology and no new purchases, can save both money and energy by being careful not to heat, cool, light or drive unnecessarily. They can, with some initial expense but later savings, move toward more energy efficient homes, autos and appliances. These actions alone would be immensely valuable: new technologies and larger changes in life style will only increase this contribution.

Global problems will take decades to bring under control. Indeed, stopping global warming is probably impossible. EPA estimates that a reduction of 80 percent of CO_2 emissions would be needed to stabilize the atmosphere at current conditions. Ultimately, new technologies such as solar hydrogen or modular nuclear power must replace fossil fuels if the world hopes to reduce emissions this much and achieve

acceptable living standards for the world's population. This is particularly critical because of current inequities in energy use among industrialized and developing countries.

One government role here is clear--to be sure we have the non-polluting technologies available as soon as possible. Funding for research, development, and demonstration for renewable energy--solar, wind, geothermal--has greatly decreased in the last decade. Current funding is not adequate to enable these non-greenhouse technologies to be brought on line within the next few decades. Nuclear power research funds from the government have not suffered, but they have not been focused on units with world-wide applicability. Even if nuclear power were deemed to be politically acceptable in principle, the specific technologies available could still be seen as unacceptable in many countries.

Whether for this transition, or for the general relief from the harmful environmental effects of using energy, societies should focus on reducing fossil fuel emissions now through a combination of energy conservation and use of efficient technology. The United States has already made strides in this direction. For example, energy efficiency standards for appliances have led to the production of new refrigerators that use much less electricity than their predecessors and at no significant change in cost.

How do we promote use of the most energy-efficient equipment? While information on "energy-saving" equipment (e.g., insulation, high efficiency windows, cars, lightbulbs, furnaces, water-heaters) is more clearly available than information on "environmentally friendly" products, there are still several barriers to adopting the most efficient equipment. Despite some labeling, consumers (whether as individuals, or purchasers for industry, commerce, or government) usually do not buy the device that uses least energy over its lifetime (which also may be the cheapest to operate, over its

lifetime). These obstacles include limited cash at time of purchase, cheap energy prices (and therefore low value attached to saving energy), and choice patterns that favor 'tried and true' over new untried high technology.

The Federal government can provide leadership in many ways: procurement (by putting energy efficient equipment in Federal facilities), financial incentives (guarantee markets for new technology, incentives or rebates), or regulation (setting performance standards for equipment (from appliances to buildings, to utilities, to cars). In fact, government generally lags rather than leads the public in these critical areas. Government agencies at all levels of management should be models for the Nation...and Congress and State legislatures should insist on such performance.

Beyond efforts in the end-use sector, government also can assist in supply-side decisions. The traditional rate regulation of utilities links profit to increased energy use. Least cost planning--a way utilities can value conservation as much as new supply--is being adopted by several states, but the Federal Government could seek ways to ensure that all states use this concept. The government also could set efficiency standards for electric utilities.

However, in the long run, the most important thing the government can do is send a resounding signal through society that use of fossil fuel use is very costly to the environment. High sulfur coal use leads to expensive acid rain cleanup. Excessive use of imported oil keeps the United States tied to foreign markets and, through automobile emissions, continues to exacerbate urban ozone. Making it more difficult or costly for everyone to pollute air, water, or soil would encourage both individuals and businesses to find solutions rather than government mandate a particular course of action.

Conclusion

True environmental solutions do not all lie in simple technology fixes that can be handed to us. A serious dent in the buildup of greenhouse gases, for example, ultimately requires changing how we think and use energy. This theme has emerged in one form or another over the last few decades and often evokes images of sacrifice--in fact, lifestyles have changed and will change in the future.

We live quite differently than our parents and grandparents did, and our descendants will live in a different world than we know. The nature of employment has changed with the increasing entry of women in the work force and as the U.S. economy shifts from heavy industry to a much larger service sector. Computers have revolutionized teaching, banking, and most business transactions. FAX machines, fiber optics--the list of things that change lifestyles positively is endless. Equally important, but less often considered, are negative impacts on lifestyle such as traffic congestion, urban sprawl, acidified lakes, chemical and oil spills, harbor pollution, eroding coastlines.

Our lifestyles change as surely from the pollution we create as it does from trying to clean it up. One of the most compelling reasons to begin to attack pollution problems is that most solutions to one environmental problem help with another. Acid rain, urban smog, ozone depletion, congestion in cities, groundwater contamination, and waste problems are coupled tightly together. Pollution concerns need to be brought to the forefront of the American decision-making process. With proper incentives, leadership, regulation and the availability of consumer information, the pattern of behavior can change towards environmentally sound consumption of natural resources.

We need to start thinking in terms of environmental protection, not as an afterthought to be treated as a constraint in decision-making, but as an objective, to be part and parcel of our goals and priorities.

Senator GORE. Very good, excellent. All three statements were really helpful to us and we appreciate them very much.

There has to be a balance as well between what individuals do and what government does to make broader changes possible and feasible and likely. But focusing for a moment just on the individual, and I am looking for very brief responses here, if you had to list not 50, but just three things that are the most important things an individual can do to help the environment, what would they be?

Dr. Lyons?

Dr. LYONS. Well, let me just offer one. There are three of us, so you can get three from the three of us.

Senator GORE: OK.

Dr. LYONS. I have not thought about it quite that way. But first, of course, I think that the less energy one uses, the less all of these other problems, including some of the things about packaging and so on, cause difficulty.

So the first thing you can do is reduce your energy consumption. That means worrying about the labels on the things you buy if they are labeled for energy efficiency, looking at the mileage on the car that you purchase, recycling wherever possible, and of course, at home, insulate the attic.

The very first thing you do in the home is get knee-deep in insulation up in the attic, and if you have done that then you can begin to think about the rest of the house. We have known that for a long time. If everyone would do that, we would be way ahead.

So that is actually a series of things related to energy consumption.

Senator GORE. Good.

Mr. Flavin?

Mr. FLAVIN. Well, John just stole my first idea, so let me move to idea number two, which would be to look at one's transportation and to figure out both whether, if you are purchasing a car, you might purchase one that is substantially more efficient than the one you have today, but also looking immediately at public transportation alternatives, looking at the feasibility for cycling, and to figure out a way that you can both be using less fuel and putting less carbon dioxide into the atmosphere each day.

Beyond that—and again it gets to this business of coupling policy with personal action—I would like to see anybody who is going to focus on their own personal transportation systems also put some pressure on the government. Why do we not have an effective Federal policy today to encourage fuel efficiency? Why do we have——

Senator GORE. That is my next question.

Mr. FLAVIN. Sorry.

But also to focus on the corporations, and why are the corporations irresponsible? I think the two really do go hand in hand.

Senator GORE. OK. Dr. Andelin?

Dr. ANDELIN. The answers are energy conservation, home and transportation; more careful consideration of the problem of trash, municipal solid waste, including purchasing and recycling decisions; And to support the political leaders that are in tune with that individual's ethic.

Senator GORE. All right, very good. Now, none of you mentioned water. In most of Tennessee we do not have what I would call a

water shortage at all, although in some cities we do and at some times of year we do.

I think some people are a little confused about this. Is there a need to conserve water everywhere in the United States?

Mr. FLAVIN. Well, if I could try addressing that, certainly it is an issue that is somewhat regionally specific, in that generally the western part of the country has the most serious water shortage and will continue to face these issues for many decades.

However, water consumption tends to have some other effects associated with it. One is that as we consume large amounts of water that go into the sewage system, basically you have a higher volume of material to deal with. So there is an environmental effect there.

Senator GORE. So we should conserve water everywhere?

Mr. FLAVIN. Everyone should conserve water, hot water in particular. A tremendous amount of energy goes into heating that water.

Senator GORE. Anybody else want to comment on this one?

Dr. LYONS. I agree with that.

Senator GORE. All right. Now, if you had to list, not 50, but just three things as the most important things the United States government could do to make it easier for individuals to save the environment, what would those three things be? Dr. Lyons?

Dr. LYONS. Well, I would start with information.

Senator GORE. More money for NIST would be the priority?

Dr. LYONS. You said that, Mr. Chairman.

I think information. If you think back to the seventies, when we were all in the grip of the oil embargoes and gasoline lines and so on, a lot of information was developed around the country and then was given a lot of publicity by various government agencies.

DOE used to do a great deal of that in those days, things like energy audits, you remember, where you got the information from your energy suppliers. The power companies would send you literature and so on.

That seems to have faded away. We went into a different era in the eighties and now we are going yet again in another era in the nineties. But I do think that a very cost-effective thing we can do is just get the word out on the things that we know.

It may be timely to go back and tell people what we used to tell them about saving energy in the home, for example.

Senator GORE. All right, very good.

Mr. Flavin, you started to get into this just a second ago. Do you want to list three?

Mr. FLAVIN. Let me focus on three things that are all within the energy arena, but I think collectively they can have an enormous impact. One is a comprehensive program to encourage much greater fuel efficiency in our automobiles, and I think that that has to include a combination of much tighter fuel economy standards and incentives as well.

In terms of Federal spending, we still have our priorities largely backwards, where we are focusing research and development funds on old nuclear technologies and on fossil fuel technologies. We are still putting a piddling amount of money into renewable energy and efficiency. Those priorities essentially need to be reversed.

And third, in the utility area, as I mentioned earlier, we have both a Federal and in many cases State policies that in effect encourage fossil fuel use, that in effect encourage inefficiency. And we need, both within the Federal Energy Regulatory Commission and the Department of Energy a commitment to development of a non-carbon-based energy system, and a message sent out to consumers and to States that signals that that is in fact the key priority.

There are obviously a lot of specific policies that flow from that, but I think turning the policy framework around is the starting step.

Senator GORE. All right. Dr. Andelin?

Dr. ANDELIN. I would probably put fossil fuel policy first, whether or not we leave the markets as they are or in some way affect them such as with the carbon tax that people talk about for global warming. Making some of the harder decisions about materials policy is in that same category.

R&D on conservation and renewable is way below what needs to be done if some of these problems are to be solved within a generation or two.

And setting an example, including procurement (making markets).

Senator GORE. Very good. I was reminded when we invited you to testify at this hearing that not only did we work together when I came to the House Science Space and Technology Committee, but you were working there for quite a while before I came to the Congress. And back in 1973 you helped prepare a committee report entitled "Individual action for energy conservation," listing lots and lots of simple things individuals can do to save the Earth.

The similarity between your report and this best-selling book, between some of the things in your report and some of the things in this book are really striking. Did you distribute 1.6 million copies of that report?

Dr. ANDELIN. In fact, we printed about 10,000 directly, and I tried to work with the House leadership to have them sent to every home in the country via the newsletter from each Member, so each Member would get credit for it.

The House of Reps at that time said that would be too expensive to send to every household, and we switched to individual Members. I do not have a count any more. It is long lost.

Senator GORE. There were a bunch sent out.

Dr. ANDELIN. A few dozen members did put them in their occasional newsletter, and that is 100,000 copies to a district typically, I guess.

Senator GORE. That is a bunch of them.

Dr. ANDELIN. So I imagine there were a half a million out there or more.

Senator GORE. Well, for at least some of those ideas this bestseller was an effort in recycling in more ways than one.

Dr. ANDELIN. If I might, Mr. Chairman, what that always reminds me of, though, is that the information is not as important as the action on that information.

Senator GORE. Right.

Dr. ANDELIN. That is what we hope your hearing and Earth Day will bring.

Senator GORE. Well, as Yogi Bera once said in an oft-quoted remark, "It is deja vu all over again" for some of the recommendations.

But I would like to close by thanking each of you again for being here and helping us. I thought your testimony was excellent, and we plan to follow up on what you have said with specific recommendations which I hope will come out of the committee.

So thank you all very much. We appreciate it.

[Whereupon, at 11:52 a.m., the committee was adjourned.]

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